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THESIS

EFFECT OF INCREASED OPERATIONAL TEMPO (POST 9/11) ON THE RETENTION OF NAVY MEDICAL CORPS OFFICERS

by

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March 2006

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This thesis seeks to determine if increased OPTEMPO has a significant effect on the retention behavior of Navy physicians. Demographic and military experience variables were used to construct logistic difference-in-difference (DID) regression models to evaluate the behavior of General Medical Officers (GMOs) and specialists making continuation decisions before and after Operation Iraqi Freedom. Although the groups were similar across time, the DID models illustrate a diverging impact of deployments on continuation after the OPTEMPO increased.

The DID model indicates that GMOs affected by increased OPTEMPO were significantly less likely to continue. Continuation was also hindered by being black, being Hispanic, and being single with dependents. Factors promoting continuation included: years of service, being a flight surgeon, being an Undersea Medicine physician, and being a member of a race/ethnicity group other than white, black, or Hispanic.

Similarly, the DID model indicates that specialists who deployed after the OPTEMPO increased had a substantially higher probability of separation. The probability for leaving was increased for specialists who are not in primary care. The probability of continuation was higher for individuals with more years of service, those single without dependents, those deployed before the OPTEMPO increased, and those assigned to Naval Medical Center, San Diego.

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EFFECT OF INCREASED OPERATIONAL TEMPO (POST 9/11) ON THE RETENTION OF NAVY MEDICAL CORPS OFFICERS

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

Conscription ended on June 30, 1973, and since then the U.S. Armed Forces rely upon volunteers to fill their ranks (Warner and Asch, 2001). The dawn of the all-volunteer force (AVF) ushered in a wave of concerns about attracting and retaining enough human capital to sustain the capabilities of the armed forces, particularly when economic conditions are favorable and/or when the nation is involved in conflict. Occasionally, these concerns appear well founded. With a tight civilian labor market, the U.S. Armed Forces missed enlistment recruiting goals by 6,000 in Fiscal Year (FY) 1998 and 8,500 in FY 1999 (Warner and Asch, 2001). More recently, several military services experienced recruitment challenges while engaged in the Global War on Terrorism (GWOT) despite recent pay increases and enhanced incentives. Clearly, the length and nature of current operations are more arduous than those previously experienced by the AVF. As the flexibility and resilience of the AVF is tested, disparate outcomes are expected for different segments of the military population.

The operational tempo (OPTEMPO)[1] of the United States military has increased dramatically since the end of the Cold War (Fricker, 2002). The post-Cold War military downsizing partially explains the amplified OPTEMPO, but changes in the U.S. National Security Strategy also led to military involvement in a myriad of humanitarian, disaster relief, peacemaking, and peacekeeping operations (Hosek and Totten, 2002). On September 11th, the military's operational environment changed for the foreseeable future. Subsequently, Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) have further intensified the OPTEMPO of all military services. Thousands of military personnel were immediately impacted by unexpected deployments to extremely hostile environments. Furthermore, these deployments often exceed the traditional deployment length with minimal turnaround time between deployments. Under these conditions, many military members may re-evaluate their career decision, choosing

[1] Operational tempo is the number of days a military unit or individual service member operates away from home station (Rumsfeld, 2005).

instead to pursue a safer, more stable career in the civilian sector. The probability of this occurrence is likely elevated for highly skilled members with lucrative civilian opportunities, such as physicians.

The military services constantly struggle to recruit and retain ample physicians to support their mission. The booming healthcare industry and ongoing military conflict contribute to recruiting and retention troubles. In recent years, the Navy achieved its physician recruiting goals; however, meeting the 2005 goals for both active and reserve recruiting will be difficult (Hoewing, 2005). In fact, the Navy only achieved about 58 percent of the recruiting goal for active duty physicians and just 60 percent of the goal for reserve physicians in 2005. In addition, the attrition rate for Navy physicians in FY 2003 was 9.2 percent, slightly higher than the three-year average of 8.9 percent (Cowan, 2004). Furthermore, the loss rates in some specialties exceed 22-27 percent, creating severe shortages in critical wartime specialties (Cowan, 2002). More troubling, the attrition rate is expected to climb based on retirement and resignation requests. Higher OPTEMPO and longer deployment durations have been cited as the major reasons for this increase (Cowan, 2004).

The 2005 Quick Poll[2] conducted by Navy Personnel Research, Studies, and Technology (PERS-1) confirm the potentially detrimental impact of increased OPTEMPO on Navy Medical Corps officer retention. The results illustrate that six of the top ten factors influencing Medical Corps officers to leave the Navy are related to OPTEMPO.[3] As well, the results show that civilian job opportunities influence the retention decision of 70 percent of the physicians participating in the survey (Newell et al., 2005). The combined effects of increased operational requirements and the lure of civilian employment could produce long-term deficits in the inventory of Navy

[2] The 2005 Quick Poll was conducted May 11th-23rd 2005. All Officers in the Medical, Dental, Medical Service, and Nurse Corps communities were selected to participate in the online survey. The overall response rate was 33 percent including 1,321 Medical Corps officers (34 percent of Medical Corps officers).

[3] The six OPTEMPO factors influencing Medical Corps officers to leave the Navy and their respective percentages include impact of deployments on your family (70 percent), unpredictability of deployment (69 percent), overall time spent away from home (63 percent), impact of being in the Navy on family (62 percent), frequency of deployment (60 percent), and length of deployments (55 percent).

physicians. Also, agricultural costs[4] and time necessary to replace departing physicians can create significant short-term consequences. Moreover, physician retention difficulties could produce spillover effects impacting force health protection capabilities and beneficiary care; thereby creating retention challenges elsewhere. This thesis seeks to determine if the actual retention behavior of Navy Medical Corps officers at their first decision point is significantly different subsequent to the increased OPTEMPO prompted by the events of September 11th, primarily after the start of OIF.

B. BACKGROUND

1. Navy Medical Corps

Unique among the corps of the Medical Department, the Medical Corps was never legally chartered; however, it is common knowledge that surgeons served aboard the first and subsequent naval vessels of the United States. Although the term, "medical corps", appears in a number of official and unofficial historical documents written in the late 1700's, the birth of the Medical Corps is recorded as 3 March 1871. The birth date was established based on an appropriations act that specifically referred to "officers of the medical corps on the active list."[5] This legislation also standardized relative ranks of medical officers and established the title of Surgeon General (Bureau of Naval Personnel, 1969).

Prior to the passage of the Universal Military Training and Service Act of 1950[6], the "Doctor Draft" law, medical officers for the regular Navy were obtained exclusively by volunteer application; however, the induction of reserve medical officers was allowed through the "Ensign 1915" program. Later, the "Berry Plan" offered two options to physicians graduating from medical school; begin active duty immediately to fulfill their military obligation or defer military service until completion of approved specialty training. In the event that an insufficient number of physicians entered the military through voluntary programs, the Selective Service System held special drafts to meet the

[4] Agricultural costs are the costs that the Navy pays to attract and retain physicians. Generally, this includes recruitment costs, medical school costs and Graduate Medical Education for physician specialists.

[5] Appropriation Act, approved by Congress, 3 March 1871 (16 Stat.535)

[6] On 9 September 1950, Public Law 779 (Doctor Draft law) amended the Selective Service Act of 1948.

deficit. If drafted, physicians were required to immediately enter the military regardless of civilian practice or residency training (Bureau of Naval Personnel, 1969).

Currently, medical officers enter military service through a variety of accession programs; Armed Forces Health Profession Scholarship Program (AFHPSP), Uniformed Services University of the Health Sciences (USUHS), Financial Assistance Program (FAP), and direct accessions. The majority of physicians enter under the AFHPSP where the military pays for their medical school education. The Uniformed Services Health Profession Revitalization Act of 1972 authorized the AFHPSP and USUHS as complementary programs to provide the military with new means of obtaining active duty physicians once the draft ended in 1972. This thesis focuses primarily on physicians accessed through AFHPSP and USUHS. Those accessed through USUHS commit to a seven year minimum active duty obligation (ADO) and most AFHPSP accessions serve four year ADOs. Further, the ADO may be extended by the physician's participation in Graduate Medical Education (GME). In addition to providing critical specialty training to meet wartime manpower requirements, the GME program serves as a recruitment and retention tool.

As leaders of the Medical Department team, Medical Corps officers are generally responsible for the treatment of sick and injured personnel, the prevention and control of disease, and maintaining the health of command personnel. Without a doubt, Force Health Protection is the most important mission of Naval Medicine. Force Health Protection is comprised of five basic components;

1. Preparing a healthy and fit force,
2. Deploying medical personnel to protect our warriors in the battlefield,
3. Restoring health on the battlefield,
4. Providing care to our retired warriors through TRICARE for Life, and
5. Providing world-class health care for all beneficiaries (Arthur, 2005).

Achievement of this mission while responding to increased requirements to augment the operational forces fighting the GWOT was greatly enhanced by Naval Medicine's Total Force Integration Plan, utilizing both active and reserve manpower

inventories (Cowan, 2003). The Naval Reserve component is extremely important in supplementing the active duty medical force, especially during prolonged periods of conflict.

2. Operational Tempo (OPTEMPO)

With an officer corps that is 31 percent smaller in 2000 than in 1986, today's military personnel face deployments of increasing frequency, many of which are unplanned and unforeseen (Fricker, 2002). One effect of the GWOT has been a significant increase in OPTEMPO (Rumsfeld, 2005). Since September 11th, approximately one-third of the Fleet has been deployed on any given day. Although similar to peace-time operations, the OPTEMPO of forward deployed units has increased (Krol, 2002). When analyzing OPTEMPO, two broad categories are generally used; hostile duty and non-hostile duty.[7] The expeditionary nature of the Navy/Marine Corps team requires constant readiness for short notice deployments to a myriad of missions, both hostile and non-hostile. While fighting the GWOT, the Navy and Marine Corps also deployed personnel to several short-fused contingency operations; a Non-combatant Evacuation Operation in Liberia, a peacekeeping mission in Haiti, a humanitarian assistance mission to support South Asian tsunami victims, and a disaster relief mission following Hurricane Katrina, among others. Each of these missions necessitated the support of Navy medical personnel, scores of which were activated from their shore-duty assignments.

Although some Medical Corps officers are permanently assigned to operational units such as ships, aircraft squadrons, and Marine Corps units, most are assigned to a component unit of a Medical Treatment Facility (MTF). During national emergencies or contingency operations, and when directed, selected medical units and/or individuals are mobilized from their respective MTF to support operational requirements. Similarly, reserve Medical Corps officers are often mobilized to backfill MTF jobs vacated by their active duty counterparts; however, they are increasingly being mobilized to support operational units on the battlefield directly. In fact, more than 1,000 Naval Reserve

[7] Hostile duty is duty in an area or circumstance involving imminent danger, for instance, the operations in Haiti, Somalia, peacemaking and peacekeeping in Bosnia and Kosovo, and current operations in Iraq and Afghanistan. Non-hostile duty may involve unaccompanied tours abroad, sea voyages in non-hostile waters, disaster relief, humanitarian aid, nation building, and combined exercises (Hosek, 2004).

medical personnel were mobilized to active duty in support of OIF (Cotton, 2004). On April 18, 2004, nearly one in six of Naval Medicine's deployable personnel was deployed in support of operations fighting the war on terrorism. At that point, in excess of 7,300 active and reserve naval medical personnel had deployed in support of OIF (Cowan, 2004). During the age of the AVF, only Operations Desert Shield and Desert Storm compare to this level of mobilization, but the length and nature of current operations are substantially different.

3. Personnel Tempo of Operations Program (PERSTEMPO)

By the nature of their business, military members expect a certain level of OPTEMPO. Assignment onboard ships and other operational platforms virtually guarantee at least one deployment and numerous operational exercises during the Inter-Deployment Training Cycle (IDTC). Members with long sea rotations may experience upwards of three deployment cycles while assigned to a single platform. In an effort to manage OPTEMPO and ensure a reasonable quality of life for Sailors and their families, the Navy instituted the Personnel Tempo of Operations (PERSTEMPO) Program in October 1985. Prior to its implementation, long deployments were more common, but less often associated with national crises. Accordingly, Sailors experiencing high underway time (non-deployed) and long deployments were reenlisting less frequently (Golding and Griffis, 2003).

The Navy institutionalized its PERSTEMPO program with rules restricting the length of deployments, setting a floor on the time between deployments, and constraining the total time away from homeport[8] (Golding & Griffis, 2003). OPNAVINST 3000.13B expresses the primary drive of the program as preserving the quality of life while meeting national obligations. Although the program applies to all active duty Navy commands and units, some unique units are designated as special PERSTEMPO program units due to their inability to meet PERSTEMPO program goals.[9] While the policy was developed

[8] The PERSTEMPO policy limits deployments to a maximum of 6 months (portal to portal), provides a minimum turn around ratio of 2.0:1, and requires that units spend a minimum of 50 percent of their time in homeport over a 5-year cycle calculated 3 years back and 2 years forward based on current schedules.

[9] Special PERSTEMPO program units include permanently forward deployed units operating with rotating crews, Navy Mobile Construction Battalions, Fleet Ballistic Missile Submarines, Aviation Training Squadrons, Cryptologic Direct Support Personnel, and any operating/deploying command/unit whose personnel are assigned for less than 3-5 year tours and receive compensation for extended operating time beyond PERSTEMPO Program limits.

to preserve Sailors' quality of life and retention, the standards were imposed on units, not individuals. As a result, congressional legislation in 2000 directed the military services to monitor the PERSTEMPO of individuals and pay them for excessive time away (Golding and Griffis, 2004).

4. Individual Tempo Program (ITEMPO)

The National Defense Authorization Act for FY 2000 expanded the services' PERSTEMPO programs with a requirement to track PERSTEMPO on an individual basis. For this reason, the Navy developed its new Individual PERSTEMPO (ITEMPO) program to control the amount of time that every Sailor is required to be away from his/her homeport or permanent duty station. Initially, Sailors exceeding 250 days deployed, in a rolling 365-day calendar, were entitled to $100 per day for each additional deployment day.[10] The Navy sought to manage the program by requiring flag officer reviews when members reached 182 deployment days and again at the 220 deployment day mark. Due to the expeditionary nature of the Navy and Marine Corps, the Navy pursued changes more harmonious with its operational pattern. The proposed changes sought a new threshold of 500 deployment days in a two-year rolling cycle before Sailors were paid "high deployment pay." The FY 2001 National Defense Authorization Act recognized the unique nature of the Navy and Marine Corps by allowing 400 deployment days over a 2 year rolling period before high deployment pay was triggered. Although ITEMPO also applied to reservists serving on active duty, the FY 2002 National Defense Authorization Act tightened the initial guidance by applying the same "can't go home at night" rules (Navy Personnel Command web page).

Implementation of the ITEMPO program requires exacting management at all levels to succeed. The overriding goal is to minimize the hardships of military service on Sailors and their families. The imposition of significant financial costs was designed to curtail unreasonable separation due to military deployments or at least compensate Sailors for the inconvenience. The earliest that anyone would have qualified for high-deployment pay was November 2001. Regrettably, the terrorists' attacks on September 11th, 2001 caused the Department of Defense (DoD) to suspend the high-deployment pay

[10] Deployment days were originally defined as any day that a Sailor was away from his/her permanent duty station such that he/she could not go home at night; however, exceptions were allowed for schools and watch-standing.

aspect of ITEMPO indefinitely. While commands must still report all qualifying ITEMPO events, the individual member's ITEMPO calendar remains frozen until the suspension is lifted (Rhem, 2001).

5. Retention

To manage the overall force successfully, the military must balance accession of new members with the retention of already trained and skilled personnel (Rumsfeld, 2005). Obviously the goal is not to retain all eligible personnel; however, some critical skills warrant extraordinary efforts to meet overall manpower requirements. Given the extensive investment in human capital in a resource constrained setting, the Navy can ill-afford for retention to persistently be lower than planned levels. In fighting the retention battle, the Navy must consider factors such as the civilian economic environment, the Sailors' satisfaction with military life, the influence of family members, and Sailors' opportunities within and outside the Navy. The importance of Selective Reenlistment Bonuses, quality of life initiatives, special pays, and other retention levers cannot be overemphasized in managing Sailors' retention behavior. Yet, several wartime critical specialties remain undermanned. Within the Medical Corps, these specialties include anesthesiologists, cardio-thoracic surgeons, and orthopedic surgeons (Cowan, 2002).

Absent a draft, the Navy depends on some physicians to continue on active duty voluntarily to fill upper-level manpower requirements. The principal impediment, to date, has been the disparity between military compensation and comparable civilian earnings, the civilian-military pay gap. To mitigate the deficiency and secure their continued service, the Navy offers several special pays to eligible physicians: variable special pay[11], board certified pay[12], additional special pay[13], incentive special pay[14], and

[11] Variable special pay is an automatic entitlement for Medical officers serving on active duty for periods of at least 1 year.

[12] Board certified pay is an entitlement for medical officers who are board certified in a medical specialty recognized by the American Board of Medical Specialties or the Bureau of Osteopathic Specialties, or has attained Board Certification Equivalency.

[13] ASP is entitlement for Medical Corps officers who agree to remain on active duty for a period of not less than 1 year as computed from the effective date of the ASP agreement.

[14] Incentive special pay is a discretionary bonus given to Medical Corps officers intended to assist in alleviating shortages of medical officers who meet specified criteria.

multi-year special pay[15]. Despite the mixture of special pays, the Navy is persistently challenged to preserve the appropriate assortment of physicians. Facing a greater than ever civilian-military pay gap and a booming healthcare industry, the increased OPTEMPO experienced by military physicians during the GWOT may further complicate retention efforts.

C. PURPOSE OF THE STUDY

The purpose of this thesis is to explore and identify the significant factors associated with the behavior of United States Navy Medical Corps officers at their first retention decision. The primary focus is the effect of deployments on the probability of retention but also includes other factors that may influence retention such as subspecialty, duty station type/location, and some demographic characteristics.

D. RESEARCH QUESTIONS

The primary research question of this thesis is whether or not the increased OPTEMPO subsequent to the events of September 11th has had an effect on the retention of Medical Corps officers at their first decision point. Secondary research questions are:

- Are Medical Corps officers facing increased deployments less likely to continue on active duty relative to those who are not deployed?
- Do the factors affecting the retention decision of Medical Corps officers vary significantly by demographic characteristics?
- Does subspecialty have any effect on the continuation decision of Medical Corps officers?
- Does duty type/location affect the continuation behavior of Medical Corps officers? In particular, does assignment to either Naval Medical Center, Portsmouth, National Naval Medical Center, Bethesda, or Naval Medical Center, San Diego affect the continuation behavior of physician specialists?

[15] Multi-year special pay is a discretionary bonus given to Medical Corps officers intended to alleviate the most severe shortfalls in medical specialties. This bonus is additive to all other medical officer special pays.

E. ORGANIZATION

Chapter II provides a review of literature associated with the general issues of military retention, civilian healthcare retention, military physician retention, and effects of operational tempo on retention. Chapter III describes the data sources, details the methodology used to collect the data, provides a preliminary data analysis of the 1999 and 2002 cohort data files, and discusses the analytical methods employed during the analyses. Chapter IV explains the dependent variable and the selection of the explanatory variables, and tenders rationales for expected outcomes of explanatory variables. Chapter V presents the results of the analyses for General Medical Officers and specialists. Chapter VI offers conclusions and recommendations based on the analyses while indicating areas for further research.

II. LITERATURE REVIEW

A. RETENTION IN THE MILITARY

As with any civilian organization, the military constantly struggles with the problem of retaining enough high-quality personnel. The military's retention challenge is especially daunting during periods of economic prosperity and when comparative civilian wages significantly outweigh military compensation. Given the substantial direct and indirect costs associated with employee turnover, the military has made considerable investment in empirical research to identify important factors related to retention plans and retention behavior of military personnel. Typically, military research has been conducted in one of three ways: large-scale surveys, economic models of occupational choice, or theory-based conceptual models (Weiss et al., 2003).

Results from large-scale surveys of military personnel have commonly been used to describe a host of factors associated with the intentions of military personnel to remain in the military (Weiss et al., 2003). For instance, the General Accounting Office's report of preliminary results from the Department of Defense 1999 Survey of Active Duty Members (Rabkin, 2000) used large-scale survey techniques to provide descriptive research on retention. On the whole, the results showed a strong link between members' overall satisfaction with military life and their likelihood to stay in the military. With regards to turnover, service members reported that basic pay, amount of personal and family time, quality of leadership, job enjoyment, and deployments were the most important factors influencing their decision to leave active duty (Weiss et al., 2003).

Multivariate retention models based on principles of general economic theories of occupational choice is another common method utilized to examine retention in the military. In short, the basic premise of these models is that rational individuals make their occupational decisions in a utility maximizing framework. For military personnel, the utility maximizing framework implies that individuals seek to maximize utility by making a decision either to stay in the military or leave the military for the civilian sector (Weiss et al., 2003). The concept of utility maximization encompasses both pecuniary and non-pecuniary factors. The Annualized Cost of Leaving (ACOL) is a model based

on economic theory that is often used for analyzing retention behavior. In the ACOL model of retention, the individual is assumed to compare the utility of leaving the military immediately with the utility of remaining for each possible future period of service. The utility from staying or leaving depends on both the present value of the income stream and the present value of the monetary equivalent of any non-pecuniary aspects (Mehay & Hogan, 1998). In general, multivariate models help the military formulate policies. For example, Warner and Goldberg (1984) estimated an ACOL model indicating that a higher incidence of sea duty was associated with lower levels of first-term retention rates in the Navy. Since its development, the ACOL model has undergone two major refinements; ACOL-2 and the Stochastic Cost of Leaving model. The refined versions represent a new class of multivariate models – Dynamic retention models (Weiss et al. 2003). These refines essentially recognize that individuals differ by unobserved factors.

The final method generally used in research conducted on military retention is the proposal and empirical evaluation of specific conceptual models of retention behavior (Weiss et al., 2003). Utilizing the 1992 DoD Survey of Officer and Enlisted Personnel and their Spouses, Kerr (1997) proposed such a conceptual model for retention of first-term and second-term enlisted Marines. Kerr suggested that retention was a function of demographic characteristics, military experience, cognitive satisfaction with military life, and external factors such as alternative civilian job opportunities. Further, Kerr stratified the sample by gender and term of enlistment, creating four groups. His results demonstrated that many of the factors proposed were significant predictors of retention behavior; however, none were significant across all groups. Thus, processes leading Marines to separate from the military were different for first-term and second-term males and females.

B. CIVILIAN HEALTHCARE RETENTION

The characteristics of the healthcare labor shortage are so often repeated that they have virtually become a mantra for healthcare executives. Two out of three healthcare organizations are experiencing labor shortages, with 50 percent reporting long-term vacancies of six months or more in key positions (Pieper, 2003). Multiple factors including a shrinking work force, an aging population, changing social attitudes toward

work, financial constraints, and public perception of healthcare contribute to a growing personnel problem for healthcare organizations across the country (Wolf, 2001). As a result, they face an insufficient supply of nurses, pharmacists, and physicians. In terms of the number of physicians, the number of medical school graduates remains relatively stagnant. So, we are beginning to see signs of a significant physician shortage (Lanser, 2003). Recently, the American Medical Association confirmed the shortage of physicians in some regions and specialties while predicting additional shortages in the future (American Medical Association web page, 2005). Given the concern that the labor shortage is generating, healthcare leaders should explore innovative ways – incentives, formalized career paths, continuing education, or mentoring – to hold on to the best employees (Lanser, 2000).

Pathman et al. (2002) studied how physicians' relative satisfaction and/or dissatisfaction influenced their plans for leaving their job. Using a cross-sectional mail survey of 1,939 practicing generalists and specialists across the United States, they employed logistic regression analysis to assess whether physicians in the top and bottom quartiles of satisfaction were more or less likely to anticipate leaving their jobs within 2 years, compared with physicians in the mid-satisfaction quartiles. More than one-quarter of physicians anticipated a moderate-to-definite likelihood of leaving their practices within 2 years. Further, their results showed that relative dissatisfaction with pay and with relationships with communities was associated with plans for leaving in nearly all physician groups.

Rittenhouse et al. (2004) attempted to validate physicians' self-reported intentions to leave clinical practice using a 1998 survey of urban California specialist physicians, the American Medical Association (AMA) Physician Master File, and direct ascertainment of physicians' practice status in 2001. Multivariate regression was used to predict both physicians' intentions to leave clinical practice and their actual departure. Their analysis indicated that the strongest predictor of both intentions to leave clinical practice and actual departure from practice was older age. In addition, physician dissatisfaction had a strong association with intention to leave clinical practice, but was

not associated with actual departure. As such, Rittenhouse et al. conclude that self-reported intention to leave practice may be more of a proxy for dissatisfaction than an accurate predictor of actual behavior.

The economic boom of the 1990s created an unprecedented period of prosperity, characterized by low inflation and low unemployment. During this period, the labor market for critical healthcare personnel tightened dramatically. Good economic times combined with ever-expanding career opportunities exacerbated the cyclical labor shortages in healthcare. While much was written about the nursing shortage, healthcare organizations also faced a decreasing supply of caregivers in other areas. Thus, retaining the quality employees a healthcare organization already has is a considerable challenge (Ashbaugh, 2003). In fact, the Workforce Efficiency study from Watson Wyatt Data Services showed that turnover rates within the healthcare industry during 2004 were higher than the overall industrial average and ranged from 18.6 percent for nonexempt employees to 15.9 percent for exempt employees (Report on Salary Surveys, 2005).

C. RETENTION OF MILITARY PHYSICIANS

The recruitment and retention of military physicians has plagued DoD since the inception of the AVF. Although the Uniformed Services Health Profession Revitalization Act of 1972 assisted with the recruitment of military physicians, retention remains a persistent challenge. While most empirical studies focus on the civilian-military pay gap as the major retention barrier, other factors affect physicians' retention behavior; e.g., accession source, specialty, gender, race, and satisfaction with military life. Given the organizational structure, career paths, and multitude of physician specialties, the first stay-leave decision is generally identified as the most critical point for intervention.

Gaffney (1988) utilized the 1985 Department of Defense (DoD) Survey of Officer and Enlisted Personnel and Military Spouses to analyze career orientation[16] among DoD physicians. Gaffney employed ordinary least squared (OLS) multiple regression, logistic (logit) regression, and factor analysis to isolate the factors that affect the career

[16] Career Intention, the dichotomous dependent variable, was constructed from a survey question. Physicians who expected to serve less than 20 years were classified as short-term and those who expected to serve greater than 20 years were classified as long-term.

orientation of DoD physicians. Abraham Maslow's "hierarchy of needs"[17] theory and Frederick Herzberg's "two-factor"[18] theory provided the basis for his selection of factors for analysis. This turnover analysis was conducted on four cohorts: all physicians, single physicians, married physicians, and couples (married physicians and their spouses). Demographic variables including gender, race, branch of service, and marital status were also included in the models that were estimated.

All physician cohorts considered wages a significant factor in their military career decision. Those indicating that they had sought civilian employment also had a significantly lower probability of military career orientation in all but one cohort, single physicians. Gender was only significant for the single physician cohort; indicating that single females had a higher probability of military career orientation than single males. Race was uniformly insignificant across cohorts. The impact on families became clearer in the couples cohort where family and adaptability concerns had a significant and negative impact on military career orientation.

Franco (1989) made use of multivariate logistic regression to estimate the influence of demographic, tenure, economic, and perceptual variables on the retention behavior of Lieutenant and Lieutenant Commander Navy physicians with nine or fewer years of service. Franco merged the 1985 DoD Survey of Officer and Enlisted Personnel with 1988 retention data, the 1985 Bureau of Medicine Information System (BUMIS) Medical Officer File, and the 1985 Medical Economics Survey of Civilian Physician Earnings to develop a retention model. Franco's analysis showed no statistically significant impact from race, marital status, gender, or the military/civilian pay differential. Statistically significant variables that negatively influenced retention behavior included Lieutenant Commander (tenure), board certified specialists, trained specialists, and General Medical Officers when compared to Lieutenants in residency

[17] Maslow's "hierarchy of needs" theory identified five basic needs: physiological, safety, social, self-esteem, and self-actualization. Furthermore, Maslow contends that behavior is dominated by unfulfilled needs with basic needs taking precedence. Thus, people systematically satisfy their needs beginning with the most basic and working up the hierarchy.

[18] Herzberg's "two-factor" theory divides work factors into satisfiers and dissatisfiers. A high degree of reward for satisfiers produces job satisfaction, but a low degree produces dissatisfaction. In contrast, a high degree of reward for dissatisfiers produces indifference and a low degree produces dissatisfaction.

training. Intrinsic and extrinsic job satisfaction variables produced a statistically significant positive influence on the retention behavior of Navy physicians.

McMahon (1989) also developed a logit model to analyze the factors that influence the retention behavior of Navy fully trained physician specialists. She constructed the population of fully trained specialists from BUMIS data and derived comparable civilian wages from American Association of Medical Colleges (AAMC) survey data. Although she focused on the military-civilian pay difference, her analysis controlled for other factors, such as family responsibilities (dependents), age, minority status, years of service towards retirement, propensity for military life (based on repeated decisions to stay by unobligated physicians), and the physicians' source of entry. The retention model predicted the likelihood that an individual specialist would decide to leave at the decision point and each unobligated physician was assumed to make a retention decision annually.

McMahon's model validated the assertion that higher civilian-military pay differentials were related to increased probability of leaving the Navy. Having dependents was associated with an increased probability of leaving while higher age and being black or female were associated with decreased probability of leaving the Navy. Furthermore, she computed specialty-specific elasticities for 22 specialty classifications to refine the model illustrating that the civilian-military pay gap had varying implications for the probability of leaving the Navy based on the physician's specialty.

Brannman et al. (2000) evaluated Navy physician retention as part of their Provider Satisfaction Study. In particular, they were interested in determining if identified dissatisfiers, including the military-civilian pay gap, were influencing Navy physicians to leave the military at greater rates than before. The continuation rates appeared to remain steady between 1984 and 1999, however, aggregate continuation rates do not distinguish between voluntary and involuntary continuation. Therefore, Brannman et al. developed a way to isolate those Navy specialists who were eligible to make a stay/leave decision, but data limitations prevented them from isolating only those physicians making their first critical stay/leave decision. As such, they analyzed all unobligated physicians. They summarized the retention results by three major groupings:

surgical, evaluation and management, and ancillary specialties. Further, they compared results in two time periods, FY87-92 (Pre-TRICARE) and FY93-98 (Post-TRICARE), in an attempt to determine whether physician retention had fallen as a result of TRICARE.

Brannman et al. (2000) showed that retention of physicians with surgical specialties had declined since TRICARE was implemented. The Pre-TRICARE retention was 33 percent compared to 20 percent since TRICARE began. They also found similar patterns of declining retention in the other two groups. Brannman et al. ascribed the declining retention to a widening military-civilian pay gap, inefficient working conditions and business practices, and a general devaluation of clinical excellence. Furthermore, they asserted that the factors affecting Navy physician job satisfaction were being exacerbated by the increasing emphasis on provider productivity and optimization, without a commensurate alignment of staff and resources to achieve those goals.

Christensen et al. (2002) provided a historical overview and retention analysis of Navy specialty physicians. Their analysis showed that retention patterns were substantially different after the April 1988 change in obligation policy associated with GME training.[19] Specifically, they found that the percentage of AFHPSP direct accessions that eventually became residents (and by definition specialists) was about 14 percentage points lower after FY 1988 than before it. Furthermore, the cumulative retention of fully trained specialists 2 years after completion of their initial active duty obligation was 7 percentage points higher since April 1988. Christensen et al. contend that the combined increased attrition before residency and reduced attrition after it may explain why overall attrition rates were largely unchanged since FY 1987.

Christensen et al. stratified the pool of specialists to provide more meaningful analysis. Since some specialties had a small number of physicians, they used three broad categories to classify specialists – primary care specialists, surgical specialists, and other specialists. The specialists were grouped as follows:

[19] Before April 1988, in-house residencies were obligation neutral; however, the in-house residencies required a 2-year minimum service requirement upon residency completion. After April 1988, in-house residencies incurred a year-for-year obligation, but the obligation could be served concurrently with any existing AFHPSP or USUHS obligation.

- Primary care specialties – family practice, internal medicine, pediatrics, and preventive/occupational medicine.
- Surgical specialties – general surgery, neurological surgery, OB/GYN, ophthalmology, otolaryngology, orthopedic surgery, and urology.
- Other specialties – aerospace medicine, anesthesiology, dermatology, emergency medicine, neurology, nuclear medicine, pathology, physical medicine, psychiatry, and radiology.

With regard to primary care physicians, Christensen et al. found the cumulative attrition rates before and after the obligation change were 35 and 39 percent, respectively, but the difference was not statistically significant. Furthermore, the average cumulative attrition rates 1, 2, 3, and 4 years after completion was 50, 55, 60, and 63 percent. Overall, the attrition rate for primary care physicians remained unaffected. Conversely, the cumulative attrition rates for surgical specialists at ADO completion were lower after the obligation policy change than before it. Specifically, the cumulative attrition rate was 59 percent before the policy change and 44 percent after the policy change. The 15 percentage point difference was statistically significant. Similarly, the cumulative attrition rates for other specialists before and after the obligation policy change were 54 and 38 percent, respectively. As with the surgical specialists, these attrition rates were statistically significant indicating a lower cumulative attrition rate following the policy change.

Clearly, Navy physicians have lucrative civilian alternatives to military service. Thus, the civilian-military pay gap is often cited as the major retention challenge; however, other factors influence retention behavior. In general, longer initial obligated service yields a higher retention rate; however, specialty opportunities in the civilian sector create some variance. Increasingly, the pressures of operating in a managed care environment are affecting retention behavior. Regardless, the Navy has achieved sufficient physician retention overall, but the recently increased OPTEMPO may significantly alter physicians' retention behavior.

D. OPERATIONAL/PERSONNEL TEMPO AND RETENTION

Many researchers have investigated the subject of OPTEMPO and its influence on retention. The higher OPTEMPO produced by the post-Cold War National Security Strategy is widely believed to have a negative effect on the men and women of the U.S. Armed Forces (Tillson, 1999). Yet, recent studies consistently indicate that a positive effect exists between deployment and retention. In his testimony to the House Armed Services Committee, James Hosek (2004) stated that "the most striking observation about the effect of deployment on retention is that active duty personnel have shown themselves to be highly resilient to the demands placed on them by deployment." However, Hosek acknowledged that the analysis was conducted using data from the 1990s and warned that the current operational environment may produce different results.

Cooke et al. (1992) used logistic regression to analyze the influence of PERSTEMPO on Navy enlisted retention. They combined data from several sources to capture demographic, economic, and PERSTEMPO variables. Their analysis was segmented into four different groups: (1) four-year obligors at their first reenlistment decision, (2) married four-year obligors at their first reenlistment decision, (3) sea-intensive occupations, and (4) careerists with eight to ten years of service. The analysis controlled for: demographic variables such as race, marital status, and paygrade; occupational categories like medical, supply, and surface engineering; PERSTEMPO variables including percentage of time underway (not deployed), time since deployment, and deployment length; economic variables such as unemployment rate and military-civilian pay ratio.

Cooke et al. (1992) revealed that the percentage of time underway when not deployed and longer deployments negatively influenced the retention decision of first-term Sailors. The effects were largest among married Sailors and those in sea-intensive occupations. Consequently, they approximate that a five percent pay increase, relative to civilian earnings, or a one-to-two level increase in SRB is required across the board to counteract the reductions in retention associated with increased PERSTEMPO. A much larger SRB would be required for Sailors in sea-intensive occupations.

Hosek and Totten (1998) conducted the first cross-service examination into the relationship between reenlistment and PERSTEMPO. Specifically, their study investigated the question of whether long separation or hostile duty for active duty service members in the early and mid-1990s helped or hindered retention of first-term and early career enlisted personnel. To measure PERSTEMPO, they constructed measures bearing on two aspects of PERSTEMPO: time separated from family for 30 consecutive days or more, and duty in a hostile area or for hazardous duty. Existing data for these measures were based on the receipt of special pays paid as a result of family separation or duty in an area deemed hostile, namely Family Separation Allowance (FSA)[20] and Hostile Fire Pay (HFP)[21]. Table 1 illustrates the methodology used by Hosek and Totten (1998) to classify long and hostile duty based on the receipt of FSA and/or HFP.

Table 1 Measures of Long or Hostile Duty Based on Receipt of FSA and HFP (From: Hosek and Totten, 1998)

	Family Separation Allowance	
Hostile Fire Pay	**No**	**Yes**
No	None	Long (> 30 days)
Yes	Hostile	Long and hostile

Since members without dependents are not entitled to FSA, the Defense Manpower Data Center (DMDC) constructed a unit deployment indicator[22] to deduce their non-hostile deployments. Further, they constructed four measures of long or hostile duty. Two measures were group monthly rates, and two measures were individual-member-level counts of months and episodes of long or hostile duty over a 24-month period. Table 2 defines the measures developed and used in their analysis.

[20] Family Separation Allowance is paid to members of the military that are involuntarily separated from their dependents for 30 days or more. The purpose of FSA is to partially reimburse the military member for extra expenses related to the forced separation.

[21] Hostile Fire or Imminent Danger Pay is paid to military members subject to hostile fire or explosion from hostile mines; to personnel serving in hostile fire areas or on vessels or aircraft, or in units, that engage in hostile action; and to other personnel in designated foreign areas where civil insurrection, civil war, terrorism, or wartime conditions make them subject to the threat of physical harm or imminent danger.

[22] The unit deployment indicator represents the condition where a unit consists of at least 10 members, at least 30 percent of the members have dependents, and at least 60 percent of the members with dependents receive FSA or HFP, or both.

Table 2 PERSTEMPO Measures of Long or Hostile Duty (From: Hosek and Totten, 1998)

Measure	Definition
Long or hostile duty – unit	The monthly rate associated with unit separation/deployment, e.g., the unit may be stationed abroad on an unaccompanied tour, afloat on a sea tour or deployed on a peace operation.
Long or hostile duty – total	The monthly rate inclusive of unit and individual (non-unit) duty. Service members may have long or hostile duty even though their unit does not.
Months of long or hostile duty	A service member's total months of long or hostile duty over 24 months.
Episodes of long or hostile duty	A service member's separate episodes of long or hostile duty over 24 months.

Hosek and Totten (1998) used a logit specification to relate the probability of reenlistment to a set of explanatory variables. Their analysis found that having some long or hostile duty rather than none increased reenlistment. The positive effect, however, was reduced as total and hostile months of duty increased. The reduction occurred prominently among first-term personnel and weakly among early-career personnel. With regard to episodes, personnel with at least one non-hostile episode were much more likely to reenlist than those with no episode. But as more of the episodes became hostile, the positive effect of episodes on reenlistment declined. They postulated that with increased hostile deployments, the overall positive effect of deployments might eventually become negative.

Specifically, Hosek and Totten (1998) showed that first-term Army, Navy, and Marine Corps personnel with no prior long or hostile duty were more likely to reenlist if given an initial three months of non-hostile duty – 28 percent more likely in the Army, 8 percent in the Navy, and 6 percent in the Marine Corps. Conversely, if given an initial three-month deployment to hostile duty, only Army first-term personnel were more inclined to reenlist. Such initial hostile duty did not substantially change the reenlistment

probabilities among first-term Navy, Marine Corps, and Air Force personnel. Regarding first-term personnel with previous long or hostile duty, assigning Army, Navy and Air Force personnel to an additional three months of non-hostile duty reduced reenlistment probabilities between 3 and 5 percent, but it had no effect on Marine Corps reenlistments. However, if those additional assignments involved hostilities, reenlistment probabilities dropped – by 17 percent in the Army, 11 percent in the Navy, 6 percent in the Marine Corps, and 2 percent in the Air Force. Although early careerists were more acclimatized to operational requirements, some long or hostile duty increased reenlistment probabilities in all services by 6 percent to 11 percent. Nevertheless, the prospect of hostile duty beyond that initial amount reduced reenlistment likelihood typically to a level slightly below what it would have been if the service member had no long or hostile deployments.

Kirby and Naftel (1998) explored the topic of whether Reserve mobilization affected the retention of enlisted reservists following Operation Desert Shield/Storm. They combined data from the 1991 Guard/Reserve Survey of Officers and Enlisted Personnel and the Quarterly Master Personnel Files drawn from the Reserve Common Component Personnel Data System to obtain a longitudinal history of each respondent for three years after the survey period. Their sample included 3,269 enlisted reservists with 4-12 years of service of whom 1,752 were mobilized and 1,517 were not mobilized. Separate models were developed for those with 4-6 years of service and those with 7-12 years of service. Although mobilized reservists had a 5 percent lower retention rate, the difference was marginally insignificant. Furthermore, the overall component differences between mobilized and non-mobilized groups are small and statistically insignificant despite significant difference among components. In addition, some evidence suggested that the probability of being mobilized in future call-ups had a small and positive effect on retention.

Since branches of the military service employ inconsistent terms and definitions for tempo-related events, Tillson (1999) developed three cause-related definitions to

explain tempo-related problems: deployment tempo (DEPTEMPO)[23], personnel tempo (PERSTEMPO)[24], and operating tempo (OPTEMPO)[25]. Tillson explained that the effects of tempo are often multiplied when a service member is affected sequentially or simultaneously by the three types of tempo. With respect to DEPTEMPO alone, Tillson found that most service members expected to deploy to contingencies and most looked forward to such activities. Further, only those with multiple deployments described DEPTEMPO as a problem. Multiple deployments arose in two principal ways. First, a service member either had a high demand/low density skill or was attached to high demand/low density unit. Second, because of normal rotation of individuals among units (PERSTEMPO), some members incur multiple deployments as the military rotates units among contingencies. The complex interactions between DEPTEMPO, PERSTEMPO, and OPTEMPO create difficult and varying challenges for military leaders. Tillson's research attributed the preponderance of the troubles to an obsolete military personnel system.

Hosek and Totten (2002) estimated two models of deployment and retention in their effort to determine whether deployment affects the reenlistment of enlisted members. One model viewed reenlistment as a function of deployment indicators. The second model had two equations: one for reenlistment and one for the time to E-5 promotion. In the second model, deployment had a direct effect on reenlistment, but it also had an indirect effect. The indirect effect operated through the effect of deployment on the time to E-5, and the effect of expected time to E-5 on reenlistment. By allowing the error terms in the promotion and reenlistment equations to be correlated, unobservable factors affecting both outcomes could be detected. The models were estimated by branch of service for first- and second-term personnel making a reenlistment decision between FY 1996 and FY 1999.

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[23] DEPTEMPO is the tempo related to deployment of individuals and units to meet the demands of the National Security Strategy, as in Bosnia or Saudi Arabia, or simply to meet day-to-day forward presence needs.

[24] PERSTEMPO is largely the tempo created by the personnel system, e.g., permanent change of station moves, termination of command tours, and assignment to schools.

[25] OPTEMPO is the work-related tempo that service members face on a day-to-day basis even when they are not suffering from deployment tempo.

Hosek and Totten's deployment/reenlistment model treated reenlistment as a function of the member's deployment variables, education level, Armed Forces Qualification Test (AFQT) score category, occupational area, race/ethnicity, gender, dependency status, unemployment rate at entry, current unemployment rate, and fiscal year. The two-equation model retained the same variables in the reenlistment equation but also inserted the expected time to promotion to E-5. Their promotion equation included the variables in the reenlistment equation, indicators of the member's promotion speed to E-4, and indicators of the calendar quarter when the member entered military service.

Hosek and Totten (2002) again used HFP and FSA to construct their deployment measures. Similar to their 1998 study, they used a DMDC-constructed indicator of unit deployment for members that were not eligible for FSA. Two measures were constructed from the PERSTEMPO file: deployments and months of deployment. Both measures were counted over a three-year period ending three months before the month of the reenlist or leave decision. The three-month "buffer" was utilized to control for reverse causality.

With few exceptions, Hosek and Totten's one-equation model indicated that reenlistment among members who deployed was at least as high as reenlistment among members who did not deploy. In point of fact, reenlistments for those deployed were often considerably higher. When deployments negatively influenced reenlistment, the effect was minimal. For first term personnel, reenlistment typically rose with non-hostile deployments and it did not change with respect to hostile deployments. In particular, first-term reenlistments in the Army, Air Force, and Marine Corps rose with the number of non-hostile deployments; however, reenlistments among Navy members with some deployments were higher, but reenlistments did not rise with the number of non-hostile deployments. Hostile deployments for first-term personnel had a small effect on reenlistment. For Army and Marine Corps personnel, reenlistment changed little as the number of hostile deployments increased. Conversely, first-term Air Force and Navy personnel, who previously deployed for non-hostile missions, reenlisted at lower rates as

their hostile deployments went from zero to one or from one to two. Moreover, the full-interaction specification model[26] revealed that first-term members with the most deployments were less likely to reenlist.

Hosek and Totten (2002) demonstrated that second-term reenlistments for all military services generally rose with non-hostile deployments and with the first and second hostile deployment. In contrast, second-term reenlistments declined somewhat for Army and Marine Corps members with three or more hostile deployments but did not for Navy or Air Force members.

The joint model of promotion speed and reenlistment indicated that time to E-5 was shorter with a greater number of non-hostile deployments but was little affected by the number of hostile deployments. Although deployment tended to reduce time to E-5, the reduction was small. Furthermore, Hosek and Totten (2002) found that a shorter expected time to E-5 resulted in only slightly higher reenlistment probability. The authors also determined that regardless of deployment type, members with dependents had a higher reenlistment probability which tended to increase with the number of hostile and non-hostile deployments.

Fricker (2002) investigated the association between long and/or hostile deployment duty and the retention of junior and midgrade officers in all branches of the military. He used the same deployment measures created by Hosek and Totten (1998) that were based on the receipt of special pays during deployment – FSA and HFP. The data analyzed were drawn from the PERSTEMPO database and contained all officers on active duty between December 1987 and September 1999. For junior officers, those officers commissioned after December 1986 whose initial obligation ended before September 1998 were included in the analysis.[27] For midgrade officers, Fricker included those officers whose initial obligation expired between November 1992 and September 1998. Junior and midgrade officers were modeled separately since many junior officers leave the military after their initial obligation. Furthermore, each military service was

[26] In the full interaction specification, the deployment variables indicate combinations of non-hostile and hostile deployments.

[27] Fricker's analysis looked one year after the expiration of each officer's initial service obligation and evaluated those who remained on active duty versus those who did not. The one-year period allows for delays in leaving caused by no fixed term of service and required resignation notice.

modeled independently to account for differences in services' policies, practices, and organizational cultures. In each model, he evaluated the effect of long and/or hostile deployments within 36 months of the expiration of initial service obligation or 36 months prior to the officer's exit date (or September 1999 if still on active duty), for junior and midgrade officers respectively.

Since other factors can affect the retention decision, covariates for occupation, race, gender, accession source, and family status[28] were included in the junior officer model. The midgrade officer model included additional time-varying covariates for rank, educational level, whether the officer had been promoted in the last year, whether the officer received an advanced degree in the past two years, and indicators for each year. The model for junior officer retention after initial service obligation was based on logistic regression techniques. The midgrade officer retention models were based on survival analysis techniques.

The results of Fricker's analysis of junior officers showed that the number of deployments significantly reduced officer separations. The number of hostile deployments was significant in increasing officer separations in the Air Force. After 1995 when the drawdown of the officer corps stabilized, the number of deployments increased officer separations in the Navy, but continued to reduce separations in the Army. Hostile deployments after 1995 raised officer separations in the Army and the Marine Corps. In addition, female officers in the Army and Air Force were more likely to separate than their male counterparts. Across services, those with dependents were less likely to separate from the military. Finally, race produced varying effects across services with African-Americans and Asians in the Army and African-Americans in the Air Force experiencing lower separations while Hispanics in the Navy were more likely to separate than their white peers.

Fricker's midgrade officer results again provided a lower separation rate for those who deployed; however, hostile deployments for midgrade officers revealed differences across services. Midgrade officers in the Navy were less likely to separate if they deployed to hostile areas, but the likelihood of separation for midgrade officers in the

[28] Family status variables included either single or had dependents at the end of the initial service obligation.

Army and Air Force increased following a hostile deployment. As in the junior officer model, midgrade officers with dependents were less likely to separate from all branches of the military. Female midgrade officers in the Army and Air Force were still more prone to separation; however, female midgrade officers in the Navy separated less frequently than their male peers. African-American midgrade officers were universally less likely to separate from any branch of service than their white counterparts.

Fricker also evaluated officer retention with respect to only the demographic variables producing identical results. Across all services and ranks, officers with families were more likely to remain on active duty compared to their single colleagues. Female officers in the Army and Air Force generally separated more frequently than male officers while Navy midgrade female officers separated less often than male officers. With respect to racial differences, midgrade minority officers were less likely to leave service; however, Hispanic junior officers in the Navy were more likely to leave the military.

Golding and Griffis (2004) sought to update the Cooke et al. study by analyzing Sailors' retention behavior using 1990s personnel and ship employment data. The previous study utilized 1980s data, but it may not reflect current trends since the Navy's PERSTEMPO guidelines became effective in 1986. Golding and Griffis tested the relationship between reenlistment and PERSTEMPO by merging individual ship data with personnel data to characterize Sailors' PERSTEMPO experiences. Next, they compared the arduousness of Sailors' deployment[29] experiences with their reenlistment behavior. Finally, to measure the effect of high PERSTEMPO on Sailors, they conducted regression analyses using logit specifications of Sailors' reenlistment behavior, with each Sailor as the unit of observation.

Golding and Griffis (2004) merged data from the Enlisted Master Record with deployment data from the Ship Employment History to create a final data set containing

[29] Deployment was defined as time away from homeport greater than 56 days (not including extended overhauls and maintenance away from homeport). Ships and submarines assigned to overseas homeports were excluded from analysis due to unreliable data.

information for 46,283 Sailors, after restrictions and exclusions[30] were imposed. Their analysis included PERSTEMPO measures for deployment length, turnaround ratio, the time since last deployment, and non-deployed underway days. Furthermore, they controlled for in-port workload, Sailor's ability, ship characteristics, economic opportunities, and Sailor's demographic characteristics. Unlike the earlier Cooke et al. study, they found no effect from long deployments on reenlistment. Conversely, short deployments (under 4 months) yielded higher reenlistment probabilities. Sailors with the quickest turnaround displayed reenlistment rates 1.9 percentage points lower, whereas Sailors with the slowest turnaround had reenlistment rates 1.2 percentage points higher. In addition, Sailors experiencing significant non-deployed underway time and long maintenance activities while in port also reenlisted at lower rates. When analyzing PERSTEMPO effects during Desert Shield/Desert Storm, Golding and Griffis concluded that PERSTEMPO experiences were less important to reenlistment decisions for participants than for the other Sailors studied.

The literature review on OPTEMPO and its impact on retention reveals that the effect varies across services, groups, and time. Cooke et al. (1992) showed that the percentage of time underway when not deployed and longer deployments negatively influenced retention, particularly among married Sailors and those in sea-intensive occupations. In contrast, Hosek and Totten (1998) discovered that having some long or hostile duty rather than none increased reenlistment. The positive effect, however, was reduced as total and hostile months of duty increased. Further, personnel with at least one non-hostile episode were much more likely to reenlist than those with no episode. Within the Reserve component, Kirby and Naftel (1998) found that differences between mobilized and non-mobilized groups were small and statistically insignificant. In addition, some evidence suggested that the probability of being mobilized in future call-ups had a small and positive effect on retention. Similarly, Hosek and Totten (2002) showed that reenlistment among members who deployed was at least as high as reenlistment among members who did not deploy; however, the effects differed for hostile deployments depending on branch of service. This finding was consistent with

[30] The sample was restricted to Sailors who had served at least 30 months on their surface ship and who had completed a deployment. Sailors stationed overseas, those who cross-decked, women, Training and Administration of Reserves (TAR) Sailors, and prior service Sailors were excluded.

their previous study where hostile episodes reduced the positive reenlistment effects. In the same way, Fricker (2002) demonstrated diverse outcomes for junior and mid-grade officers. Unlike Cooke et al. (1992) and Hosek and Totten (1998), Golding and Griffis (2004) showed that long deployments, following implementation of PERSTEMPO guidelines, were insignificant in affecting retention behavior. On the other hand, a rapid turnaround time significantly influenced retention. Although most studies controlled for many additional observable factors that could affect retention, some factors such as patriotism are not easily quantified. Despite the initial display of patriotism, the current operational environment of the GWOT, characterized by multiple, long hostile deployments with minimal turnaround time, could exert stronger influences on retention behavior. Therefore, current OPTEMPO effects on retention may substantially deviate from the generally observed positive effect.

E. EFFECT OF OPTEMPO ON RETENTION OF MEDICAL PERSONNEL

Research regarding the impact of OPTEMPO on the retention of medical personnel is extremely limited. Due to increased concerns, Kirby and Naftel (1998) specifically investigated the retention of reserve enlisted medical personnel following Operation Desert Shield/Storm. Their analysis found no statistical difference in retention of medical and non-medical enlisted personnel, either in their bivariate or multivariate analyses. Likewise, Fricker (2002) controlled for occupational field in his study on the effect of long and/or hostile deployment duty on the retention of junior and midgrade officers. Accordingly, Fricker calculated odds ratios for junior officers and hazard ratios for midgrade officers based on their occupation. These ratios demonstrated that junior and midgrade officers serving in the medical field who had experienced a non-hostile or hostile deployment were less likely to separate than other officers in the medical field who did not deploy.

Pierre (2005) analyzed the effect of increased OPTEMPO (Post-9/11) on the retention of first-term Navy Hospital Corpsmen. She obtained two data files from DMDC, one for first-term Hospital Corpsmen on active duty on September 30, 1998 who were eligible to reenlist/separate prior to September 11, 2001 and another file for Hospital Corpsmen on active duty on September 11, 2001 who could reenlist/separate prior to March 2004. She estimated a logit model that incorporated individual and

organizational factors to evaluate the effect of increased OPTEMPO on retention. The study results indicated that first-term Hospital Corpsmen who deployed were more likely to reenlist, regardless of whether they were deployed from a shore duty or sea duty assignment. Furthermore, those who deployed following the terrorists' attacks on September 11th reenlisted at higher rates than those who did not deploy during that timeframe.

F. CONCLUSION

An overview of the literature illustrates that retention is an important issue for both the private and public sectors. Mainly, the concern revolves around the significant direct and indirect costs associated with people leaving their organizations. For years, the military's risk of turnover was compounded as they struggled to maintain pay parity with the civilian sector. Although much progress has been made in closing the military-civilian pay gap, some occupations still experience substantial pay differentials. Military health care professionals, particularly physicians, are probably the most significantly impacted. Therefore, the military employs a variety of special pays to entice physicians to continue their military service. Unfortunately, a myriad of non-pecuniary factors also influence the retention behavior of physicians.

Despite their increased discomfort with the military's implementation of managed care business practices, physician retention rates have not suffered substantially, probably because these same pressures also exist in the civilian sector. Yet, one non-pecuniary factor that is predominately associated with military service could significantly alter physicians' retention behavior – increased OPTEMPO. Previous research on the effects of OPTEMPO on retention reveal varied results; however, an overall positive trend is reported in most recent studies. Nonetheless, several studies showed a significant difference between the effects of hostile and non-hostile deployments. In comparison, the length and nature of military operations during previously studied periods were substantially different than military operations following September 11th, particularly since the beginning of OIF. Although Pierre (2005) found that deployments since September 11th increased the retention of first-term Hospital Corpsmen, we cannot assume that the same effect exists for physicians who face considerably larger financial incentives in the civilian sector.

The focus of this thesis is to evaluate whether the current operational environment, characterized by frequent hostile deployments with minimal turn-around time, has affected the retention behavior of Navy physicians. Similar to Pierre's analysis for Hospital Corpsmen, the analysis utilizes a logistic regression framework consisting of basic demographic and military experience variables to discover key attributes that impact the physician's first retention decision. Further, a difference-in-difference estimator is employed to calculate the effect (if any) of deployments since the OPTEMPO increased. No previous research has focused on the possible impacts of increased OPTEMPO on the retention of Navy physicians. Considering the present physician recruitment and retention challenges, any further obstacles could erode the ability of Navy Medicine to fulfill its mission to support the war fighter.

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III. DATA SOURCES, GENERAL METHODOLOGY, PRELIMINARY DATA ANALYSIS, AND ANALYTICAL METHOD

A. DATA SOURCES

No single data source provides sufficient data to analyze the effect of deployment on Medical Corps officer retention. Although the Bureau of Medicine Information System (BUMIS) is often recognized as the most reliable data source for Navy physicians, it was unavailable for this analysis. Instead, data from three readily available sources were used: the Officer Master File, the Health Manpower Personnel Data System, and the individuals' pay file. The Officer Master File provided general demographic information while the Health Manpower Personnel Data System provided specific professional information to identify when physicians, either generalists or specialists, made their first retention decision. The individuals' pay file identified whether or not a physician received deployment pays, FSA and/or HFP. The Defense Manpower Data Center (DMDC) compiled and combined the data by performing a social security number match for two distinct cohorts: all active duty Medical Corps officers serving in the Navy on 1 October 1999 and all active duty Medical Corps officers serving in the Navy on 1 October 2002[31]. The general methodology section details how the data within each source were utilized in the analysis.

1. Officer Master File

The Officer Master File (OMF) offered a plethora of demographic and general information; however, many data elements were either incomplete or not applicable for Medical Corps officers. The following data elements were incorporated into the analysis from this file: assigned unit identification code (UIC), years of service (YOS), gender, race, dependency status, and marital status. In addition to the initial data elements, an annual snapshot of the member's assigned UIC was utilized in the analysis. Furthermore, YOS was adjusted to reflect the YOS most proximate to the retention decision point. Most important, the OMF supplied the loss date for those officers who left military service.

[31] The 1999 and 2002 cohorts were selected for two primary reasons. First, the data in the Health Manpower Personnel Data System prior to 1999 utilized a different format and many data fields were corrupted. Second, choosing 2002 versus 2001 reduces the impact of other non-measurable factors that could affect the retention decision immediately following the traumatic events of 9/11.

2. Health Manpower Personnel Data System

The Health Manpower Personnel Data System (HMPDS) contains various data for DoD healthcare professionals. The current analysis of Navy Medical Corps officers includes data elements for source of commission, health profession begin date, subspecialty, and graduate professional education (type and source). Given the matriculation of general practitioners into specialties, an annual snapshot of graduate professional education was used to categorize medical specialists and determine the appropriate retention decision point. The corruption of the FY2000 HMPDS data presented no difficulties since previous and subsequent years were available. Similarly, the unavailability of FY2005 HMPDS data presented no significant challenges since the analysis only included physicians who faced a retention decision before the end of FY2004.

3. Pay File

The pay file supplied data indicating whether or not physicians received deployment pays – FSA and/or HFP. The monthly amounts paid to each physician are used to determine who deployed. If deployment pays were received during the month, the physician was considered deployed during that time frame. The deployment pay history for each cohort begins one year earlier in order to provide some historical deployment data for all individuals facing a retention decision. For example, deployment pay data for the 1999 cohort includes FY1998 – FY2002. Likewise, the 2002 cohort pay data includes FY2001 – FY2005.

B. GENERAL METHODOLOGY

Since AFHPSP and USUHS accessions mainly enter as General Medical Officers (GMOs), most physicians extend their initial obligation to obtain specialty training. Accordingly, separate models were developed for General Medical Officers[32] and specialists. The analysis does not extend to current sub-specialists. Key components in the analysis included: classifying the physicians into the correct category at the retention decision point based on the end of their initial obligation while accommodating

[32] General Medical Officers include physicians in subspecialty codes 15A0 (Aviation Medicine), 15F0 (General Medicine), and 15U0 (Undersea Medicine).

matriculation into medical specialties, determining which physicians deployed prior to making their retention decision, and establishing where specialists were assigned when making their retention decision.

1. End of Initial Obligation

The end of initial obligation is considered a key retention decision point. For GMOs with no residency training, the initial commitment is typically the contract obligation based on their accessioning program. USUHS accessions incur a seven year obligation and most AFHPSP accessions incur a four year obligation. All USUHS accessions and many AFHPSP accessions attend a military internship during the first year of military service. Since the military internship is obligation neutral, USUHS accessions serve eight years to fulfill their commitment while the majority of AFHPSP physicians serve five years. Using the source of commission code and the date when physicians began serving as military health professionals, a preliminary end of initial obligation was calculated. Although some AFHPSP accessions have a lesser obligation, the minimum obligation for all accessioning programs is two years. As such, physicians who separated before completing two total years of service were deleted from the sample. Similarly, not all AFHPSP accessions complete a military internship, thus they incur a shorter initial obligation. Consequently, AFHPSP physicians separating with between two and five years of service were assumed to have separated at the end of a lesser obligation. Further, GMOs that complete either Flight Surgeon or Undersea Medicine training must serve at least two years in that capacity. Therefore, some obligations were extended to meet this requirement, but most were unaffected because the initial obligation exceeded the minimum service requirement.

For specialists, the initial obligation includes the accessioning program obligation and any obligation incurred for residency training. The time spent in residency training does not discharge the initial obligation, but both obligations are served concurrently. Given the length of GME and the required payback period, the majority of physician specialists must extend their initial obligation to complete residency training. Thus, physicians who began their first specialty GME before the end of their initial obligation were classified as specialists and their obligations were adjusted accordingly. Current sub-specialists were deleted from the sample and GME beyond the first specialty

residency training was ignored due to data limitations. The following data elements from HMPDS facilitated the appropriate classification of physicians: subspecialty code, graduate professional education date, graduate professional education projected completion date, and graduate professional education source. Inevitably, some physicians pursue civilian residency training. Those who are not on active duty while attending civilian residency training incur a residency training obligation of two years. Otherwise, Table 3 details the assumed residency training obligation undertaken for military funded training. The corresponding residency training obligation was added to the GME completion date to establish when specialists were eligible to make their first retention decision.

Table 3 Residency Training Obligation

Subspecialty Code	Specialty	Residency Training Obligation
15A1	Aerospace Medicine	2 years
15B0	General Anesthesia	3 years
15C0	General Surgery	4 years
15D0	General Neurological Surgery	6 years
15E0	General Obstetrics/Gynecology	3 years
15G0	General Ophthalmology	3 years
15H0	General Orthopedic Surgery	4 years
15I0	General Otolaryngology	4 years
15J0	General Urology	5 years
15M0	General Pathology	4 years
16N0	General Dermatology	3 years
16P0	General Emergency Medicine	3 years
16Q0	General Family Practice	2 years
16R0	General Internal Medicine	2 years
16T0	General Neurology	3 years
16V0	General Pediatrics	2 years
16X0	General Psychiatry	3 years
16Y0	Diagnostic Radiology	4 years

Unlike enlisted personnel, officers do not serve for a fixed period of time and they are formally required to resign their commission to leave the military (Fricker). Therefore, most officers who decide to separate from the military are unlikely to depart exactly at the end of their obligation. To account for timing and service considerations, the analysis provides a one-year period after their initial obligation for physicians to leave before they are classified as "stayers." The assumption is that officers who depart within the one-year window intended to leave at the end of their obligation but may not have been able to leave until some time later. Hence, an adjusted end of initial obligation was created by extending the preliminary end of initial obligation by one year. Based on the loss date provided by the OMF, physicians separating before the adjusted end of initial obligation were classified as "leavers." Otherwise, the assumption is that they chose to stay in the military.

2. Deployment Indicator

The main interest of this thesis is the effect of deployment on Medical Corps officer retention; therefore, a deployment indicator was created to identify those physicians who deployed using the deployment pay data. If a physician received either FSA or HFP, or both, he or she was considered deployed. Only deployments occurring before the physician either separated or was classified as a "stayer" are considered in the analysis. Although it is possible that some physicians deployed without receiving either deployment pay, the impact is minimized by the nature of current deployments and the physicians' demographic characteristics.

3. Duty Assignment Type and/or Location

Often the type of duty or duty location can influence the retention decision, either by the nature of the assignment or by organization-specific attributes. For specialists, this thesis seeks to explore differences between being assigned to one of the "Big 3" (Naval Medical Center, Portsmouth, National Naval Medical Center, Bethesda, or Naval Medical Center, San Diego) as compared to an assignment elsewhere. Using the annual snapshot of the assigned UIC, specialists were categorized as being either assigned to Naval Medical Center, Portsmouth, National Naval Medical Center, Bethesda, Naval Medical

Center, San Diego, or assigned to a different command when they reached the retention decision point. The analysis incorporated all UICs (core and components) because the same general organizational policies apply.

C. PRELIMINARY DATA ANALYSIS

The final combined data set consisted of 1,320 observations after deleting those with missing values and applying the above mentioned constraints. Table 4 shows the number of observations by year for those eligible to make a retention decision.

Table 4 Number of GMOs and Specialists by Year of Continuation Eligibility

	1999	2002	Total
General Medical Officers	258	199	457
Specialists	552	311	863
Total	810	510	1,320

1. General Medical Officers

a. Data Description by Year

Table 5 provides a description of GMOs considered in the analysis. Frequency distributions and descriptive statistics are used to offer some insight into the characteristics of the GMOs in the 1999 and 2002 samples.

Table 5 Characteristics of General Medical Officers Eligible to Make a Retention Decision

Characteristics	1999 N=258	2002 N=199	Combined N=457
Gender (%)			
Male	74.03	76.88	75.27
Female	25.97	23.12	24.73
Race (%)			
White	81.00	76.89	79.21
Black	5.43	6.53	5.91
Hispanic	3.88	4.02	3.94
Other Race	9.69	12.56	10.94
Marital/Dependency Status (%)			
Married with children (MWC)	45.35	50.75	47.70

Married without children (MNC)	1.94	4.02	2.85
Single with children (SWC)***	1.55	24.12	11.38
Single without children (SNC)***	51.16	21.11	38.07
Years of Service			
Average Years of Service	4.90	4.85	4.88
Deployment Status (%)* **			
No Deployments	62.02	45.73	54.92
One or more deployments	37.98	54.27	45.08
Occupational Specialty (%)			
General Medicine (GM)	57.36	51.26	54.70
Flight Surgeon (FS)	34.11	41.20	37.20
Undersea Medicine (UM)	8.53	7.54	8.10
Retention (%)			
Stay	28.29	23.12	26.04

*** ChiSq statistic significant at .01 level

The preliminary bivariate analysis looking at the data by year provides limited insight into the continuation behavior of GMOs. Demographically, the samples are relatively similar except for dependency status. Males constitute a slightly higher percentage of the 2002 sample, at nearly 77 percent, compared to 74 percent of the 1999 sample. There are no significant differences in the composition of the two samples with respect to race. Further, the average years of service is slightly lower for the 2002 sample, but again the difference is insignificant. Although the distribution of MWC and MNC fluctuates, the differences are trivial. Conversely, the samples significantly vary for SWC and SNC. In the 1999 sample, single Sailors without dependents account for 51.16 percent of the sample, but only 21.11 percent of the 2002 sample. Quite the opposite, single Sailors with dependents constitute only 1.55 percent of the 1999 sample; however, they represent 24.12 percent of the 2002 sample. The significant increase of SWC and decrease of SNC, particularly SWC, might result from some element of GMO self-selection, possibly due to the increasing OPTEMPO.

With regards to deployment status, a significantly larger percentage of GMOs in the 2002 sample deployed. Approximately 38 percent of the 1999 sample deployed compared to more than 54 percent of the 2002 sample. As a consequence, the proportion of non-deployers also appreciably diverged. Non-deployers accounted for 62.02 percent of the 1999 sample but only 45.73 percent of the 2002 sample. Occupationally, the distribution of GMOs experiences minor fluctuations; however, it remains relatively constant across time periods with no significant variation.

In summary, the 1999 and 2002 samples for GMOs are demographically similar except for dependency status. On the contrary, the deployment tempo significantly increases in the latter sample. The increase in deployments also likely influenced the significant shift in the percentage of eligible single Sailors through simultaneity. For example, a single GMO with dependents in the latter sample may not apply for military residency training because he/she desires to minimize his/her active duty obligation due to the personal conflict between family responsibility and the current OPTEMPO. As a result, the number of single Sailors with dependents increases in the latter sample.

b. Data Description of GMO Stayers

Table 6 provides a more detailed insight into the continuation behavior of GMOs across the two periods.

Table 6 General Medical Officer Continuation Rates by Characteristic

Characteristics	1999 N=258	2002 N=199	Combined N=457
Gender (%)			
Male	30.89	25.49	28.49
Female	20.90	15.22	18.58
Race (%)			
White	28.23	25.49	27.07
Black	14.29	15.38	14.81
Hispanic	20.00	0.00	11.11
Other Race	40.00	20.00	30.00
Marital/Dependency Status (%)			

Married with children (MWC)	33.33	25.74	29.82
Married without children (MNC)	40.00	50.00	46.15
Single with children (SWC)	50.00	12.50	15.38
Single without children (SNC)	22.73	23.81	22.99
Years of Service			
Average Years of Service (Stayers)	5.79	6.39	6.02
Average Years of Service (Leavers)	4.54	4.39	4.47
Deployment Status (%)			
No Deployments	23.75	27.47	25.10
One or more deployments***	35.71	19.44	27.18
Occupational Specialty (%)			
General Medicine (GM)	17.57	14.71	16.40
Flight Surgeon (FS)	36.36	30.49	33.53
Undersea Medicine (UM)*	68.18	40.00	56.76

*** Chi-Sq statistic significant at .01 level
* Chi-Sq statistic significant at .10 level

Overall, the GMO continuation rate declines more than 5 percentage points from 1999 to 2002. Consistently, the percentage of male GMOs remaining on active duty is higher than the percentage of females that decide to stay; however, both male and female continuation rates declined in 2002 compared to 1999. The 15.38 percent continuation rate for black GMOs in 2002 is slightly higher when compared to their 14.29 percent continuation rate in 1999, but the continuation rate for all other races declined. The continuation rate for GMOs with dependents in 1999 was higher than those with dependents in 2002. On the other hand, single and married GMOs without dependents remained on active duty at higher rates in 2002 than the previous period. For single GMOs without dependents the 2002 continuation rate of 23.81 percent differed slightly compared to the 1999 rate of 22.73. While the average years of service for stayers increased over time, the leavers departed with fewer years of service in 2002 than in 1999.

Regarding GMOs that deployed, the 35.71 percent continuation rate in 1999 is significantly higher than the 19.44 percent continuation rate in 2002. If they did not deploy, the 1999 sample continued on active duty at a lower rate, 23.75 percent, compared to the 27.47 percent continuation rate of 2002 non-deployers. Concerning occupational specialty, all GMO sub-groups had lower continuation rates in 2002 relative to 1999, but the 28.18 percentage point decline in continuation for Undersea Medicine physicians represents the only noteworthy difference.

Clearly, the decline in GMO continuation appears across all spectrums despite minimal increases in the continuation of blacks, GMOs without dependents, and non-deployers. The most dramatic shifts appear in the behavior of physicians who deployed, those single with dependents, and Undersea Medicine physicians. Given the increased OPTEMPO, these results are not surprising.

2. Specialists

a. Data Description by Year

Table 7 details the description of specialists considered in the analysis. Frequency distributions and descriptive statistics are used to offer some insight into the characteristics of the specialists in the 1999 and 2002 samples.

Table 7 Characteristics of Specialists Eligible to Make a Retention Decision

Characteristics	1999 N=552	2002 N=311	Combined N=863
Gender (%)			
Male	71.92	71.06	71.61
Female	28.08	28.94	28.39
Race (%)			
White	88.22	86.82	87.72
Black**	1.81	4.50	2.78
Hispanic	3.44	2.25	3.01
Other Race	6.52	6.43	6.49
Marital/Dependency Status (%)			
Married with children (MWC)	71.01	73.63	71.96
Married without children (MNC)	9.42	6.43	8.34

Single with children (SWC)***	1.63	5.47	3.01
Single without children (SNC)	17.93	14.47	16.69
Years of Service			
Average Years of Service	8.81	8.75	8.79
Duty Location (%)			
Duty Outside Big Three	73.01	71.70	72.54
Duty at NNMC	7.07	7.07	7.07
Duty at NMCP	10.14	10.93	10.43
Duty at NMCSD	9.78	10.29	9.96
Deployment Status (%)* **			
No Deployments	85.87	70.42	80.30
One or more deployments	14.13	29.58	19.70
Occupational Specialty (%)			
Primary Care Specialists (PC)	48.01	43.08	46.24
Surgical Specialists (SURG)	31.88	32.80	32.21
Other Specialists (OSPEC)	20.11	24.12	21.55
Retention (%)			
Stay**	57.97	49.84	55.04

*** Chi-Sq statistic significant at .01 level
** Chi-Sq statistic significant at .05 level

Demographically, the two samples are nearly identical with two noteworthy exceptions. First, black specialists only constitute 1.81 percent of the 1999 sample compared to 4.50 percent of the 2002 sample. Second, the percentage of single specialists with dependents significantly increased from 1.63 percent in 1999 to 5.47 percent in 2002. Otherwise, the samples are relatively unwavering across the demographic dimension. Furthermore, the duty location and occupational specialty distributions appear similar across time periods. Quite the opposite, the deployment status significantly differs, as anticipated. In 1999, only 14.13 percent of specialists deployed prior to making their continuation decision. In contrast, 29.58 percent of the 2002 sample experienced deployments before reaching their decision point. Finally, the

percent of stayers significantly deviated – almost 58 percent of the 1999 sample remained on active duty while only 50 percent of the 2002 sample decided to continue their military service.

b. Data Description of Specialist Stayers

Table 8 shows the continuation behavior of specialists considered in the analysis. In evaluating whether a major change in continuation occurred, the sample size affected the significance of some variables (i.e. Hispanic) that initially appear significant.

Table 8 Specialist Continuation Rates by Characteristic

Characteristics	1999 N=552	2002 N=311	Combined N=863
Gender (%)			
Male**	59.45	51.13	56.47
Female	54.19	46.67	51.43
Race (%)			
White**	58.11	48.89	54.82
Black	60.00	64.29	62.50
Hispanic	47.37	71.43	53.85
Other Race	61.11	45.00	55.36
Marital/Dependency Status (%)			
Married with children (MWC)*	56.12	48.91	53.46
Married without children (MNC)	65.38	50.00	61.11
Single with children (SWC)#	77.78	35.29	50.00
Single without children (SNC)	59.60	60.00	59.72
Years of Service			
Average Years of Service (Stayers)+++	9.32	10.17	9.60
Average Years of Service (Leavers)++	8.10	7.34	7.79
Duty Location (%)			
Duty Outside Big Three**	59.55	50.67	56.39
Duty at NNMC	43.59	54.55	47.54
Duty at NMCP	46.43	41.18	44.44
Duty at NMCSD*	68.52	50.00	61.63

Deployment Status (%)			
No Deployments	55.49	48.86	53.39
One or more deployments***	73.08	52.17	61.76
Occupational Specialty (%)			
Primary Care Specialists (PC)**	68.30	55.97	64.16
Surgical Specialists (SURG)	44.89	39.22	42.81
Other Specialists (OSPEC)*	54.05	53.33	53.76

*** Chi-Sq statistic significant at .01 level
** Chi-Sq statistic significant at .05 level
* Chi-Sq statistic significant at .10 level
# Fisher's Exact test $P < 0.10$
+++ T-statistic for difference in means significant at .01 level
++ T-statistic for difference in means significant at .05 level

In general, the continuation rate of specialists declined approximately 8 percentage points from 1999 to 2002. Even though males and females appear to evenly absorb the decrease in continuation only the decline in male continuation is significantly different in 2002 compared to 1999. With respect to race, the continuation rate for white specialists and specialists of other races declined while black and Hispanic specialists continued at higher rates during 2002. The decline for white specialists was roughly 10 percentage points and appreciably different in 2002 compared to 1999. While the continuation rate for specialists of other races declined by over 16 percentage points from 1999 to 2002, the difference was of no consequence. The continuation rates of blacks and Hispanics increased by 4 and 24 percentage points, respectively, from 1999 to 2002, but again the change was unimportant.

Specialists with family obligations continued on active duty at lower rates in 2002 compared to 1999; however, the continuation rate of single specialists without dependents remained constant at roughly 60 percent. Those married with dependents that chose to remain on active duty significantly declined by more than 7 percentage points between 1999 and 2002. The continuation rate for married specialists without children declined by more than 15 percentage points from 65.38 percent in 1999 to 50 percent in 2002, but the change was inconsequential. The most dramatic and noteworthy decrease occurred for single specialists with dependents. Nearly 78 percent of single specialists

with dependents continued on active duty in 1999 compared to only 35 percent in 2002. Regarding total years of service, those choosing to stay had more years of service in 2002 compared to their counterparts in 1999. Similar to the GMOs, those choosing to leave service departed with fewer years of service in 2002 when compared to 1999. The divergence in average years of service between the two time periods was significant for both groups; stayers and leavers.

Specialists assigned to Naval Medical Center, San Diego appear to continue at higher rates compared to specialists assigned elsewhere; however, their continuation rates dramatically decreased by 18.52 percentage point from 1999 to 2002. In contrast, those assigned to National Naval Medical Center, Bethesda experienced an increased, but insignificant, continuation rate from 43.59 percent in 1999 to 54.55 percent in 2002. For those stationed at Naval Medical Center, Portsmouth when making their decision, the continuation rate declined a mere 5 percentage points from 46.43 percent in 1999 to 41.18 percent in 2002. Specialists assigned to commands outside of the "Big 3" also had a lower continuation rate of 50.67 percent in 2002 when compared to 59.55 percent in 1999.

All occupational specialty sub-groups experienced a lower continuation rate in 2002 relative to 1999. Primary Care specialists' continuation rates radically shifted from 68.30 percent in 1999 to 55.97 percent in 2002. The continuation rate of Surgical specialists was 44.89 percent in 1999 and only 39.22 percent in 2002. Other specialists experienced less variation in continuation, but overall the change was significant.

The non-deployers experienced a decreased continuation rate from 55.49 percent in 1999 to 48.86 percent in 2002; however, the change was insignificant. In contrast, the continuation rate for deployed specialists significantly diminished from 73 percent in 1999. to only 52 percent in 2002.

Certainly, the continuation rates for specialists have substantially declined in the latter sample. The most significant variation occurred for those deployed. Thus, the preliminary results appear to indicate that the increased OPTEMPO has significantly affected the continuation of physician specialists in a negative manner.

D. ANALYTICAL METHOD

1. Theoretical Model

Multiple regression analysis allows estimating retention models incorporating many influences. In the logistic regression model, the dependent variable is binary, where stay equals 1 and leave equals 0. The theoretical model is:

$$Li = \ln (Pi/1\text{-}Pi) = \alpha + \beta xi$$

where:

Li = log of odds ratio

Pi = Probability of continuation, given the personal attributes xi

α = Intercept parameter

β =Vector of slope parameters

xi = Vector of explanatory variables

2. Multivariate Logistic Regression Models

Listed below are the initial models used to analyze the continuation behavior of physicians. Modification (if any) will be discussed in the analysis results section for generalists and specialists. A full description of the variable definitions is provided in Chapter IV.

1. General Medical Officer Model

The initial empirical model used to find predicted probabilities for continuation of General Medical Officers is:

$$\begin{aligned}\ln (Pi/1\text{-}Pi) = {} & \beta_0 + \beta_1(\text{FEMALE}) + \beta_2(\text{BLACK}) + \beta_3(\text{HISPANIC}) + \\ & \beta_4(\text{OTHERRACE}) + \beta_5(\text{MNC}) + \beta_6(\text{SWC}) + \beta_7(\text{SNC}) + \\ & \beta_8(\text{DEPLOYED}) + \beta_9(\text{FS}) + \beta_{10}(\text{UM}) + \beta_{11}(\text{YOS})\end{aligned}$$

where:

FEMALE = being female

BLACK = being African-American

HISPANIC = being Hispanic

OTHERRACE = being any race other than white, African-American or Hispanic

MNC = being married without dependents

SWC = being single with dependents

SNC = being single without dependents

DEPLOYED = being deployed prior to making retention decision

FS = being a Flight Surgeon

UM = being an Undersea Medicine physician

YOS = an additional year of service

2. Specialists Model

The initial empirical model used to find predicted probabilities for continuation of physician specialists is:

$$\ln (Pi/1\text{-}Pi) = \beta_0 + \beta_1(FEMALE) + \beta_2(BLACK) + \beta_3(HISPANIC) + \beta_4(OTHERRACE) + \beta_5(MNC) + \beta_6(SWC) + \beta_7(SNC) + \beta_8(DEPLOYED) + \beta_9(NMCP) + \beta_{10}(NNMC) + \beta_{11}(NMCSD) + \beta_{12}(SURG) + \beta_{13}(OSPEC) + \beta_{14}(YOS)$$

where:

NMCP = being assigned to Naval Medical Center, Portsmouth when making the continuation decision

NNMC = being assigned to National Naval Medical Center, Bethesda when making the continuation decision

NMCSD = being assigned to Naval Medical Center, San Diego when making the continuation decision

SURG = being a surgical specialist

OSPEC = being any other physician specialist other than primary care or surgical

The sign of the parameter estimate indicates whether the variable is associated with an increase or decrease in the probability of continuation. The predicted Wald Chi-

square statistic indicates if a given variable is significant at the usual levels used for hypothesis testing. The chi-square statistic is derived by dividing the parameter estimate by its standard error and squaring the results. The probability of exceeding the statistic through random chance indicates whether the variable may be accepted or rejected for a given significance level.

Partial effects are evaluated using the notional person approach. The notional person defines a "typical" person to determine the overall continuation probability. The change in probability associated with any given explanatory variable that is statistically significant can then be calculated for this "typical" person.

3. Difference-in-Difference Estimator

The Difference-in Difference (or "double difference") estimator is the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome of the control group before and after treatment. For this thesis, the control group is the non-deployers in 1999 and 2002 while the treatment group contains those that deployed. The treatment is the increased OPTEMPO experienced during the latter time period.

This framework involves a simple comparison of the change in behavior of non-deployers, who were not affected by the increased OPTEMPO, with the change in behavior of deployers, who were affected by the increased OPTEMPO. Hence, to determine the Difference-in-Difference estimator, two variables are added to the previously discussed models – one to account for the common time trend and one to measure the true effect of treatment. The effect of OPTEMPO is controlled for by the DEPLOYED variable indicating whether an individual deployed. Likewise, time is controlled for by the addition of the FY02 variable representing whether each observation is for a physician eligible to make a continuation decision before or after the increase in OPTEMPO. The coefficient for the variable of interest (FY02_DEPLOYED) therefore measures the effect of being deployed, relative to not being deployed, after the OPTEMPO increased, relative to before.

Hence, the Difference-in-Difference estimator for General Medical Officers is determined by the following model:

$$\ln (Pi/1-Pi) = \beta_0 + \beta_1(FEMALE) + \beta_2(BLACK) + \beta_3(HISPANIC) + \beta_4(OTHERRACE) + \beta_5(MNC) + \beta_6(SWC) + \beta_7(SNC) + \beta_8(DEPLOYED) + \beta_9(FS) + \beta_{10}(UM) + \beta_{11}(YOS) + \beta_{12}(FY02) + \beta_{13}(FY02\_DEPLOYED)$$

where:

FY02 = time trend common to control and treatment groups

FY02_DEPLOYED = effect of treatment (increased OPTEMPO)

Similarly, the Difference-in-Difference estimator for specialists is found using the following model:

$$\ln (Pi/1-Pi) = \beta_0 + \beta_1(FEMALE) + \beta_2(BLACK) + \beta_3(HISPANIC) + \beta_4(OTHERRACE) + \beta_5(MNC) + \beta_6(SWC) + \beta_7(SNC) + \beta_8(DEPLOYED) + \beta_9(NMCP) + \beta_{10}(NNMC) + \beta_{11}(NMCSD) + \beta_{12}(SURG) + \beta_{13}(OSPEC) + \beta_{14}(YOS) + \beta_{15}(FY02) + \beta_{16}(FY02\_DEPLOYED)$$

where:

FY02 = time trend common to control and treatment groups

FY02_DEPLOYED = effect of treatment (increased OPTEMPO)

IV. VARIABLE DEFINITIONS

A. DISCUSSION

This section of the thesis defines and discusses the explanatory and dependent variables used to analyze the retention of Navy Medical Corps officers facing their first retention decision. The discussion also details the rationale for the expected effect of explanatory variables on the dependent variable. The expected signs of explanatory variables are summarized in table format.

B. VARIABLES

1. Explanatory Variables

To evaluate the continuation behavior of physicians reaching their first retention decision point, two categories of explanatory variables are used; demographic and military experience.

a. Demographic Variables

(1) Gender (MALE, FEMALE). The gender variable is binary and categorized as either male or female. The base case is MALE, for both generalists and specialists. Historically in all military branches, the type of duty and available billets were more restrictive for female service members; however, great strides have been made within the last several decades to promote an equitable working environment. Although the current limitations are less constraining for female physicians, the remaining obstacles can influence the continuation decision if viewed negatively. In addition, the enhanced integration of female Sailors onboard ship has expanded opportunities for female physicians. These expanded opportunities could also sway the continuation decision when shipboard duty is considered undesirable. Furthermore, females typically bear the largest burden of maintaining the family unit. When military responsibilities and family responsibilities conflict, female service members are probably more affected. Although these opportunities and restrictions produce differing effects, either positive or negative, based on individual preferences, the overall effect of the FEMALE variable is expected to negatively affect the continuation decision of generalists and specialists alike, especially when the OPTEMPO intensifies the conflict between military and family responsibilities.

(2) Race/Ethnic Group (WHITE, BLACK, HISPANIC, OTHERRACE). Race/ethnic group is depicted by four classes: WHITE, BLACK, HISPANIC, and OTHERRACE. The base case is WHITE. Relative to the civilian sector, the military is generally viewed as providing members of minority groups with equitable opportunities for advancement and training. If this contention holds true, minority members would be more likely to continue military service. Thus, the anticipated effect on retention of each minority group is positive for both generalists and specialists.

(3) Marital/Dependency Status (MWC, MNC, SWC, SNC). Although marital and dependency status vary over time, data limitations required the classification at the beginning of each period, 1 October 1999 and 1 October 2002. Marital/dependency status was divided into four categories: Married with dependents (MWC), Married without dependents (MNC), Single with dependents (SWC), and Single without dependents (SNC). The base case is MWC since it represents the majority of generalists and specialists. Those with family obligations (MWC, SWC, and MNC) are expected to be more career-focused; however, the family separation caused by routine deployments can create substantial personal conflict. This internal quarrel is likely heightened when the deployment entails duty within a hostile zone involved in military conflict. In particular, single individuals with family obligations are expected to be more negatively impacted by military service due to deployments because they have the sole responsibility for caring for their dependents; thus, the likely overall effect of SWC is hypothesized to be negative for specialists and generalists alike. In contrast, those without dependents, whether married or not, are presumed to be less negatively impacted than those married with dependents. Hence, the effect of SNC and MNC are projected to be positive when evaluated against MWC.

b. Military Experience Variables

(1) Deployment Status (NODEPLOY, DEPLOYED). The deployment experience of physicians is described dichotomously. The base case, NODEPLOY, represents the majority of physicians who did not deploy while DEPLOYED symbolizes those physicians who deployed at least once before reaching the retention decision point. Intuitively, the expectation is that deployments would

negatively influence continuation behavior; however, previous research findings offer different results. Fricker found that deployments (hostile or non-hostile) actually produced a positive effect on the retention of military officers; however, hostile deployments tended to lessen the positive effect. Similarly, Hosek & Totten found that deployments positively affected the retention of enlisted service members. In addition, Pierre discovered that the positive effect of deployments extended to Navy Hospital Corpsmen.

Since many General Medical Officers are expected to deploy during their first obligation, the effect could be either positive or negative depending on their personal preferences and deployment experience. Furthermore, the composition of GMOs possibly contains a comparable mixture of those positively and negatively impacted by deployment since the current analysis permits the matriculation into specialties. If a GMO dislikes the deployment aspect of military life, they may forego the opportunity to pursue military residency training and thus remain a GMO until separating from the Navy. Alternatively, if the GMO, enjoys the deployment experience, they could postpone residency training until some time after their initial obligation, choosing instead to remain a GMO where the probability for deployment is higher. As such, the anticipated effect on GMO continuation is neither positive nor negative.

Most specialists generally have limited deployment opportunities unless the nation is engaged in conflict or participating in Military Operations Other Than War (MOOTW). Similar to GMOs, the retention behavior of specialists could either be positively or negatively influenced by deployment depending on their preferences and experience. Since some specialists may have deployed as GMOs and subsequently chose to continue active military service, the supposition is that deployments do not negatively influence their behavior. However, that belief is speculative, at best, since specialists may continue on active duty only for GME, or because the chosen specialty has limited deployment possibility. The specialists that continue military service only for GME are more likely to terminate their military service, regardless of whether they deploy or not. On the other hand, physicians that are not predisposed to separation may be influenced by deployments. If they embrace the adventurous nature of the military, deployments may positively influence their continuation behavior. However, if deployments are seen as a

disruption to their personal and/or professional lives, the impact can be negative. Given the substantial change in OPTEMPO during the period evaluated in this analysis, no expectation is proposed on the effect of deployment on the retention of specialists despite the outcome of previous research. Unlike previous periods studied, the current environment has resulted in many specialists being deployed to extremely hostile environments. The volume of deployments, coupled with the duration of the present conflict, limits the self-selection mechanism that likely occurred in previous periods. Therefore, specialists that prefer not to deploy can no longer escape the expeditionary nature of military medicine. As a result, they may chose to terminate military service at higher rates than previously experienced.

(2) Years of Service (YOS). The years of service variable is continuous and represents the individual's cumulative years of creditable military service when facing the retention decision. For generalists, the variation in YOS is likely less than for specialists due to varying obligations for specialty training. Regardless, dissatisfied physicians are anticipated to separate at the earliest opportunity, with fewer years of service. Given the military's retirement plan, it is expected that the YOS variable will positively affect retention behavior because individuals with more years of service are closer to qualifying for retirement benefits.

(3) Occupational Specialty (GM, FS, UM) and (PC, SURG, OSPEC) for generalist and specialists, respectively. The base case for GMOs is General Medicine (GM) and Primary Care (PC) is the base case for specialists.

General Medical Officers typically enter the Navy with no previous military experience. For interested personnel, Flight Surgery (FS) and Undersea Medicine (UM) training opportunities are available. Since these groups receive more military-specific training, they are expected to be more likely to continue on active duty when compared to General Medicine physicians.

To ease interpretation, the specialists were grouped into categories similar to the Christensen et al. study. Table 9 reflects the specialties assigned to each group, primary care specialists (PC), surgical specialists (SURG), and other specialists (OSPEC).

Table 9 Categories of Physician Specialists

Subspecialty Code	Specialty	Specialty Category
15A1	Aerospace Medicine	Other Specialist
15B0	General Anesthesia	Surgical Specialist
15C0	General Surgery	Surgical Specialist
15D0	General Neurological Surgery	Surgical Specialist
15E0	General Obstetrics/Gynecology	Surgical Specialist
15G0	General Ophthalmology	Surgical Specialist
15H0	General Orthopedic Surgery	Surgical Specialist
15I0	General Otolaryngology	Surgical Specialist
15J0	General Urology	Surgical Specialist
15M0	General Pathology	Other Specialist
16N0	General Dermatology	Other Specialist
16P0	General Emergency Medicine	Other Specialist
16Q0	General Family Practice	Primary Care Specialist
16R0	General Internal Medicine	Primary Care Specialist
16T0	General Neurology	Other Specialist
16V0	General Pediatrics	Primary Care Specialist
16X0	General Psychiatry	Other Specialist
16Y0	Diagnostic Radiology	Other Specialist

The most often cited obstacle for physician retention is the civilian-military pay gap despite the various special pays offered by the military to enhance retention. Since physician specialists outside the primary care realm can often demand higher civilian compensation, the expected effect of SURG and OSPEC is negative when compared to PC.

(4) Duty Type/Location (NOBIG3, NNMC, NMCP, NMCSD) for specialists only. Using the annual snapshot of the assigned UIC, the duty type/location closest to the retention decision point was determined. The base case is NOBIG3 which represents all duty stations other than National Naval Medical Center,

Bethesda, Naval Medical Center, Portsmouth, or Naval Medical Center, San Diego. Duty within the Navy's largest and busiest hospitals is expected to differ from duty outside the "Big 3" due to residency training programs, increased pressure for productivity, volume of patients, and independent organizational policies. In addition, smaller hospitals, operational units, and other duty stations typically contain less bureaucracy; thereby, removing some of the administrative burden or "red tape" that often creates physician dissatisfaction. Specifically, National Naval Medical Center, Bethesda is positioned near Washington, D.C., but typically shared the overall care of beneficiaries with Walter Reed Army Medical Center. Its proximity to the nation's capital and the Navy's Bureau of Medicine and Surgery also places substantial political pressure on the staff assigned to National Naval Medical Center, Bethesda. Those assigned to Naval Medical Center, Portsmouth and Naval Medical Center, San Diego face less direct political pressure; however, they have different challenges from being located near the two largest fleet concentration areas. Furthermore, the impact of increased productivity pressure caused by the previous TRICARE contracts may have produced additional negative effects for National Naval Medical Center, Bethesda and Naval Medical Center, Portsmouth due to revised financing arrangements. Based on the culmination of these factors, the continuation behavior of those assigned to one of the "Big 3" is expected to have a negative sign when compared to those assigned elsewhere.

2. Dependent Variable (STAY)

The dependent variable is binary. If a physician, either generalist or specialist, was on active duty at the end of September 1999 (or September 2002), reached the end of his or her obligated service before October 2002 (or October 2004), and continued on active duty for longer than one year beyond his or her obligation, he or she is considered a stayer and the STAY variable assumes a value of 1. If the physician separated from active duty at any time prior to serving more than one year beyond his or her obligation, the physician is considered a leaver and the STAY value takes on a value of 0. Table 10 presents a summary of the explanatory variables and their predicted effect on the dependent variable.

Table 10 Explanatory Variables and Expected Signs

Variable Name	Variable Type	Expected Sign for GMOs	Expected Sign for Specialists
Demographic			
Gender			
MALE	Dichotomous	Base Case	Base Case
FEMALE	Dichotomous	-	-
Race/Ethnicity			
WHITE	Dichotomous	Base Case	Base Case
BLACK	Dichotomous	+	+
HISPANIC	Dichotomous	+	+
OTHERRACE	Dichotomous	+	+
Marital/Dependency Status			
MWC	Dichotomous	Base Case	Base Case
MNC	Dichotomous	+	+
SWC	Dichotomous	-	-
SNC	Dichotomous	+	+
Military Experience			
Deployment Status			
NODEPLOY	Dichotomous	Base Case	Base Case
DEPLOYED	Dichotomous	+/-	+/-
Years of Service			
YOS	Continuous	+	+
Occupational Specialty			
GM	Dichotomous	Base Case	N/A
FS	Dichotomous	+	N/A
UM	Dichotomous	+	N/A
PC	Dichotomous	N/A	Base Case
SURG	Dichotomous	N/A	-
OSPEC	Dichotomous	N/A	-

Duty Type/Location			
NOBIG3	Dichotomous	N/A	Base Case
NNMC	Dichotomous	N/A	-
NMCP	Dichotomous	N/A	-
NMCSD	Dichotomous	N/A	-

V. RESULTS OF THE ANALYSIS

A. OVERVIEW

Initially, a Log Likelihood restricted model test was performed on the pooled sample of all generalists and specialists. The outcome confirmed that separate models should be used for generalists and specialists. Next, the cross-sectional data for 1999 and 2002 were pooled and a single logistic regression model was estimated for generalists using the variables previously discussed and an indicator for year of eligibility. The results of the pooled model indicated that the year of eligibility was insignificant. As a consequence, a single model could be used for generalists. Subsequently, a single logistic regression model was estimated for the combined GMO sample; however, it failed to capture the effect (if any) of the increased OPTEMPO on GMO continuation. Therefore, the initial logistic regression model was augmented with a difference-in-difference estimator to evaluate the differing effects, before and after the increased OPTEMPO. The functional form of the model was further improved when a squared term for the YOS variable (YOSSQ) was added to the model.

With respect to specialists, the cross-sectional data were also pooled and a single logistic regression model was estimated using the aforementioned variables and an indicator for year of eligibility. The results of the pooled model illustrated that the year of eligibility was significant. A Log Likelihood restricted model test was subsequently performed and the results demonstrated that separate models for the two time periods were not necessary to analyze the specialist data appropriately. Initially, a single logistic regression model was estimated for the combined specialist sample, but it failed to indicate whether the increased OPTEMPO affected the continuation behavior of specialists. Thus, a difference-in-difference estimator was employed to determine if the increased OPTEMPO has influenced the continuation behavior of physician specialists. Additionally, to improve functional form, a squared term for the YOS variable (YOSSQ) was added to the regression model. The new variable was significant and, for that reason, retained in the specialist model.

B. GENERAL MEDICAL OFFICER MODEL

1. Initial Logistic Regression Model

The combined GMO model utilized 12 variables, eight of which were statistically significant in explaining continuation behavior. Table 11 shows the coefficient and level of significance for each variable. All results are for one-tailed tests with the exception of the DEPLOYED variable

Table 11 Logistic Regression Results for GMO Model, N=457

Variable	Parameter Estimate	Pr > Chisq
INTERCEPT	-7.5226	<0.0001
YOS***	1.5447	<0.0001
YOSSQ***	-0.0627	<0.0001
FEMALE	-0.0678	0.4173
BLACK*	-1.1220	0.0699
HISPANIC*	-1.2507	0.0687
OTHERRACE**	0.7071	0.0291
MNC	0.5403	0.1921
SWC*	-0.7078	0.0679
SNC	-0.0666	0.4042
DEPLOYED	0.1292	0.3113
FS***	0.7744	0.0033
UM***	1.4383	0.0004
Goodness of Fit Measures		
Log Likelihood Ratio (12 df)	Chi-Square = 115.9707	<0.0001
Generalized R-Square = 0.2241	Max-rescaled R-Square = 0.3284	

*** Significant at .01 level
** Significant at .05 level
* Significant at .10 level

Goodness of fit can be evaluated by several methods: global null hypothesis test, r-square, and the classification table. The global null hypothesis test and Max-rescaled R-square results in Table 11 indicate that the model has a good fit and offers some

explanatory value. Specifically, the Max-rescaled R-square for the GMO model is .3284 indicating that the independent variables explain 32.84 percent of the variation in the dependent variable. Finally, the ability of a model to classify "stayers" and "leavers" accurately provides some indication of its usefulness. The classification table results as shown in Table 12 show that the current GMO model correctly classifies 74.2 percent of the observations. The "sensitivity" results for the model show that 74.8 percent of GMOs who continued on active duty were accurately classified while "specificity" results indicate the correct classification of 74.0 percent of those who separated. Thus, the model is deemed to have a good fit.

Table 12 Classification Table for General Medical Officer Model

	Correct		Incorrect			Percentages			
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	False Pos	False Neg
.260	89	250	88	30	74.2	74.8	74.0	49.7	10.7

Despite the usefulness of the previously discussed GMO model, it fails to adequately evaluate if the increased OPTEMPO has affected the continuation behavior of GMOs. As such, a difference-in-difference estimator is incorporated into the existing model to determine if the increased OPTEMPO has influenced the continuation behavior of General Medical Officers.

2. GMO Logit Model with Difference-in-Difference Estimator

a. Incorporation of a Difference-Difference Estimator

To understand the true effect of the increased OPTEMPO, a difference-in-difference estimator is employed using the same logistic regression framework. Table 13 illustrates the outcome of the regression incorporating the difference-in-difference estimator (FY02_DEPLOYED) and a variable to capture the common time trend (FY02). All results are one-tailed tests except for the DEPLOYED and FY02 variables. The coefficient for the FY02 variable captures the change in continuation rates from 1999 to 2002 while the coefficient for the DEPLOYED variable measures the effect of being deployed that is not due to the increased OPTEMPO. The variable of interest,

FY02_DEPLOYED, measures the impact of the increased OPTEMPO on GMO continuation and was hypothesized to have a negative sign.

Table 13 GMO Logit Model with Difference-in-Difference Estimator

Variable	Parameter Estimate	Pr > Chisq
INTERCEPT***	-7.5303	<0.0001
YOS***	1.5144	<0.0001
YOSSQ***	-0.0613	<0.0001
FEMALE	-0.0690	0.4165
BLACK*	-1.1243	0.0695
HISPANIC*	-1.2885	0.0650
OTHERRACE**	0.7113	0.0289
MNC	0.7036	0.1335
SWC*	-0.6438	0.0961
SNC	-0.0746	0.3956
DEPLOYED	0.5201	0.1172
FS***	0.7635	0.0077
UM***	1.4203	0.0009
FY02	0.3430	0.3582
FY02_DEPLOYED**	-0.9587	0.0307
Goodness of Fit Measures		
Log Likelihood Ratio (14 df)	Chi-Square = 119.7020	<0.0001
Generalized R-Square = 0.2304	Max-rescaled R-Square = 0.3377	

*** Significant at .01 level
** Significant at .05 level
* Significant at .10 level

The fit of the difference-in-difference model is similar to the initial model, but the Max-rescaled R-Square indicates that 33.77 percent of the variation in the dependent variable is explained by the independent variables. The classification table results, as shown in Table 14, indicate that the difference-in-difference model correctly classifies 73.7 percent of the observations. Further, the "sensitivity" results for the model

show that 71.4 percent of GMOs who continued on active duty were accurately classified while "specificity" results indicate the correct classification of 74.6 percent of those who separated. Thus, the model is deemed to have a good fit while providing a better estimation of the effect of the increased OPTEMPO.

Table 14 Classification Table for GMO Difference-in-Difference Model

	Correct		Incorrect			Percentages			
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	False Pos	False Neg
.260	85	252	86	34	73.7	71.4	74.6	50.3	11.9

b. Interpretation and Evaluation of Coefficients

The years of service variables (YOS and YOSSQ) were found to be individually and jointly significant in the model. The positive sign of the YOS variable signifies that years of service has a positive impact on the continuation behavior of GMOs. However, the negative sign for the YOSSQ variable indicates that the overall positive effect will diminish. To evaluate the total impact of years of service, the following equation for the turning point of the quadratic function was employed: $\beta_1 \div 2(\beta_2) = 1.5144 \div 0.1226 = 12.35$. Therefore, the effect of years of service is positive but diminishing until an individual accumulates 12.35 years of service at which time the effect becomes negative. The importance of this conversion from positive effect to negative effect is minimized since more than 98 percent of the observations have less than 12.35 years of service. Furthermore, half of those exceeding the 12.35 years of service cutoff chose to stay in the military. Years of service has an overall positive effect on the continuation behavior of GMOs. As GMOs accumulate more years of service creditable towards military retirement, they are more likely to continue on active duty.

The FEMALE variable is insignificant in the model indicating that gender does not influence the continuation behavior of GMOs. It is possible that male and female General Medical Officers have similar perceptions regarding their military experience. Therefore, the continuation behavior of females may be more strongly influenced by other factors that are shared by their male counterparts.

The test for joint significance of the race/ethnicity variables (BLACK, HISPANIC, OTHERRACE) showed that being a member of a minority group significantly influenced the continuation behavior of GMOs. Both the BLACK and HISPANIC variables were statistically significant in the model at the .10 level. Although the behavior of black and Hispanic GMOs appear similar across the combined sample, their behavior differs when the combined sample is segmented. In fact, the continuation behavior of black GMOs increased from 1999 to 2002 while Hispanic GMOs continued at a much lower rate in 2002 when compared to 1999. Regardless, the effects of both variables were significantly negative on continuation with respect to white GMOs. The OTHERRACE variable was significant at the .05 level and produced a positive effect on GMO continuation compared to white GMOs in the combined sample despite the declining continuation rate in the latter time period. The unexpected and different effects of BLACK and HISPANIC may have been partially influenced by self-selection and/or OPTEMPO; however, the effect of the OTHERRACE variable was as anticipated

A test for joint significance of the marital/dependency status variables indicated that marital/dependency status does not significantly influence the continuation behavior of GMOs compared to those married with dependents. In particular, GMOs without dependents (MNC and SNC) do not differ significantly from MWC in continuation behavior. Conversely, the SWC variable was significant at the .10 level and negatively influenced continuation behavior of the group when compared to MWC, as expected. The significantly larger percentage of SWCs in the 2002 sample, coupled with their reduced continuation rates, appear to indicate that the results were influenced by self-selection and/or OPTEMPO. Regardless, the rigors of military service likely have the most negative impact on the continuation of single members with dependents.

The occupational specialty variables (FS and UM) were individually and jointly significant in the model at the .01 level. As anticipated, the positive signs indicate that being either a Flight Surgeon or Undersea Medicine physician significantly increases the likelihood of continuation when compared to General Medicine physicians. Since these specialties receive more military-specific training, it is possible that GMOs with a

higher propensity to continue military service choose to receive this training and work in these occupational fields, either before receiving specialty training or throughout their military career.

The DEPLOYED variable was insignificant leading to the conclusion that deployments before the increase in OPTEMPO had no significant effect on the continuation behavior of deployers when compared to those who did not deploy. These findings differ from the positive effect found in many previous studies (Hosek & Totten, 1998, Hosek & Totten, 2002, Fricker, 2002, Pierre, 2005).

The FY02 variable, which captures the change in continuation rate from 1999 to 2002, was insignificant in the model. Conversely, the difference-in-difference estimator (FY02_DEPLOYED) was significant in the model at the .05 level and negatively influenced the continuation behavior of GMOs, as anticipated. Hence, the results indicate that the increased OPTEMPO experienced in the latter period has produced a significant negative influence on the continuation of General Medical Officers. To determine the degree of the negative influence of increased OPTEMPO and influence of other significant variables, the partial effects are calculated.

c. Significant Variables and Partial Effects

(1) Notional Person. The notional person method is used to evaluate the partial effect of a single explanatory variable on the probability of continuation. This is done by setting all the explanatory variables to their average values if they are continuous (YOS = 4.8759 and YOSSQ = 23.7744) and to zero in the case of dummy variables (all other variables in the model). Each variable is independently tested by increasing it by one and the partial effect of that variable on the probability of continuation is determined by subtracting the result of this change from the continuation probability of the notional person (base case). According to the GMO model results; there is a 16.75 percent chance that the notional person will continue on active duty. The notional person is a married, white male with dependents. He is a General Medicine physician with 4.88 years of service and he has not deployed prior to making his continuation decision.

(2) Partial Effects. The partial effects of significant variables in the GMO difference-in-difference model are provided in Table 15. The notional person has a 16.75 percent likelihood of continuation. For someone similar to the notional person except that he has an additional year of service, the continuation rate increases by 15.38 percentage points. If an individual is similar to the notional person except that he is black or Hispanic, the continuation rate decreases by 10.62 and 11.50 percentage points, respectively. If an individual has the same characteristics as the notional person except that he is not white, black or Hispanic, the continuation rate increases by 12.32 percentage points.

The continuation rate declines by 7.19 percentage points if an individual is similar to the notional person except that he is single with dependents. Whenever an individual is similar to the notional person except that he is a Flight Surgeon or Undersea Medicine physician; the continuation rate increases by 13.41 and 28.69 percentage points, respectively. Most important, the probability of continuation declines by 9.59 percentage points when an individual is similar to the notional person except that he deployed after the OPTEMPO had increased

Table 15 Partial Effects of GMO Difference-in-Difference Model

Variable	Partial Effect
YOS***	0.15378
BLACK*	-0.10617
HISPANIC*	-0.11497
OTHERRACE**	0.12317
SWC*	-0.07193
FS***	0.13406
UM***	0.28686
FY02_DEPLOYED**	-0.0959

*** Significant at .01 level
** Significant at .05 level
* Significant at .10 level

d. Restricted Model Tests

Restricted model tests are conducted to determine whether or not a group of variables are jointly useful in a model. The years of service, marital/dependency status, race/ethnicity status, and occupational specialty variables were tested to determine their joint significance. The results of these tests are discussed below and summarized in Table 16.

The years of service variables (YOS and YOSSQ) proved to be significant at the .01 level. The results confirm the usefulness of years of service as a predictor for continuation behavior. A test for joint significance was conducted for the martial/dependency status variables with results indicating that they are not jointly significant in the model. Since the literature shows that marital/dependency status is important in retention analyses, the variables are retained in the model (Christensen et al., McMahon, Cooke et al., Hosek & Totten, 2002, and Fricker). Race/ethnicity was found to be jointly significant at the .05 level. This demonstrates that the race/ethnicity variables assist with predicting the continuation behavior of General Medical Officers. The occupational specialty variables also proved to be jointly significant at the .01 level. Therefore, occupational specialty is useful in predicting the continuation behavior of GMOs.

Table 16 GMO Difference-in-Difference Model Joint Significance Tests

Test	Wald Chi-Square	DF	Pr > ChiSq
Years of Service	49.0326	2	<0.0001
Marital/Dependency Status	3.4432	3	0.3282
Race/Ethnicity	8.6162	3	0.0349
Occupational Specialty	13.4693	2	0.0012

e. Potential Problems with Model

Potential problem areas for logistic regression models can exist due to functional form misspecification, multicollinearity, and/or omitted variable bias. Functional form misspecification can lead to biased estimators of all the coefficients by

not accounting for the relationship between the dependent and observed explanatory variables. In the GMO model, functional form misspecification was previously addressed by adding a squared term for years of service (YOSSQ). Subsequently, the YOSSQ variable was significant and therefore retained in the model.

Multicollinearity results when there is a high degree of correlation among several explanatory variables as they are measuring similar things. Multicollinearity does not produce biased estimators; however, it inflates the variances of predicted values and can produce unstable coefficients and incorrect signs. In small and moderate sample sizes, multicollinearity may result in the lack of statistical significance of individual independent variables while the overall model may be strongly significant. Variance Inflation Factors (VIFs) were evaluated for each variable in the model to test for multicollinearity. The VIF shows how multicollinearity has increased the instability of the coefficient estimate. For models with a low r-square, the preferred method to compare the independent variable's VIF to the model VIF. The model VIF is calculated using the following equation: $1 \div (1 - \text{R-square}) = 1 \div (1 - 0.2365) = 1.3098$. If the VIF for the variable exceeds the model VIF, then degrading multicollinearity may exist. The results of the VIF test for the GMO model indicated that the YOS, YOSSQ, FY02, DEPLOYED, and FY02_DEPLOYED variables have VIFs exceeding the model VIF which is expected given the nature of these variables in the current model.

Another potential problem for the GMO difference-in-difference model is omitted variable bias. The modest Max-rescaled R-square (0.3377) indicates that useful variables were omitted from the model. Variables such as civilian-military pay disparity, unemployment rate, and satisfaction with military life, among others, are often useful in explaining the retention behavior of military members. The inclusion of these variables would improve the model's predictive value and reduce any bias in coefficient estimates.

3. Comparison of Models

The initial logistic regression model indicates that deployments are unimportant in the continuation decision. Given the increased OPTEMPO, these results can be misleading especially if the increased OPTEMPO creates an opposite effect from the previous period. Since the focus of this thesis is to determine whether the effect of increased OPTEMPO produced a significant effect on continuation behavior, the

difference-in-difference model is preferred. The difference-in-difference estimator provides the results needed to determine whether the continuation behavior of GMOs was influenced by the increased OPTEMPO. The final results of the difference-in-difference model show that the increased OPTEMPO has produced a significant negative effect on GMO continuation behavior, as hypothesized.

C. SPECIALIST MODEL

1. Initial Logistic Regression Model

The combined specialist model incorporated 13 variables, of which 7 were statistically significant in explaining continuation behavior. The coefficient and level of significance is listed in Table 17. Only DEPLOYED was tested with a two-tailed test.

Table 17 Logistic Regression Results for Specialist Model, N=863

Variable	Parameter Estimate	Pr > Chisq
INTERCEPT***	-4.0217	<0.0001
YOS***	0.7860	<0.0001
YOSSQ***	-0.0235	<0.0001
FEMALE	-0.0924	0.3062
MINORITY	0.2703	0.1220
MNC	0.3338	0.1237
SWC	0.5537	0.1297
SNC**	0.4727	0.0143
DEPLOYED**	0.4264	0.0316
SURG***	-1.7409	<0.0001
OSPEC***	-1.2826	<0.0001
NNMC	-0.2444	0.2055
NMCP	-0.2115	0.2071
NMCSD**	0.4470	0.0467
Goodness of Fit Measures		
Log Likelihood Ratio (13 df)	Chi-Square = 184.6483	<0.0001
Generalized R-Square = 0.1926	Max-rescaled R-Square = 0.2577	

*** Significant at .01 level
** Significant at .05 level

The specialist model has a good fit based on the global hypothesis test and R-square presented in Table 17. Specifically, the Max-rescaled R-square for the specialist model is .2577 indicating that the explanatory variables explain 25.77 percent of the variation in the dependent variable. Additionally, Table 18 shows the classification table which indicates that the model correctly classifies 65.8 percent of the observations. As shown, the "sensitivity" results for the model show that 69.7 percent of specialists who continued on active duty were accurately classified while "specificity" results indicate the correct classification of 61.1 percent of those who separated.

Table 18 Classification Table for Specialist Model

	Correct		Incorrect			Percentages			
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	False Pos	False Neg
0.56	331	237	151	144	65.8	69.7	61.1	31.3	37.8

Unfortunately, the initial logistic regression model does not permit the evaluation of the effect (if any) of increased OPTEMPO on the continuation behavior of specialists. Therefore, the addition of a difference-in-difference estimator is necessary to facilitate the analysis.

2. Specialist Logit Model with Difference-in-Difference Estimator

a. Incorporation of a Difference-Difference Estimator

As previously done with the General Medical Officer model, a difference-in-difference estimator is employed using the same logistic regression framework to evaluate the effect of the increased OPTEMPO. Table 19 illustrates the regression results incorporating the difference-in-difference estimator (FY02_DEPLOYED) and a variable to capture the common time trend (FY02). All results are one-tailed tests except for the DEPLOYED and FY02 variables. The coefficient for the FY02 variable captures the change in continuation rates from 1999 to 2002 while the coefficient for the DEPLOYED variable measures the effect of being deployed that is not due to the increased OPTEMPO. The variable of interest, FY02_DEPLOYED, measures the impact of the increased OPTEMPO on specialist continuation and was hypothesized to have a negative sign.

Table 19 Specialist Logit Model with Difference-in-Difference Estimator

Variable	Parameter Estimate	Pr > Chisq
INTERCEPT***	-3.9078	<0.0001
YOS***	0.7717	<0.0001
YOSSQ***	-0.0228	<0.0001
FEMALE	-0.0867	0.3178
MINORITY	0.2814	0.1133
MNC	0.3203	0.1353
SWC	0.6334	0.1016
SNC**	0.4278	0.0244
DEPLOYED***	0.8601	0.0046
SURG***	-1.7343	<0.0001
OSPEC***	-1.2495	<0.0001
NNMC	-0.2578	0.1936
NMCP	-0.1876	0.2354
NMCSD**	0.4627	0.0423
FY02	-0.1735	0.1730
FY02_DEPLOYED**	-0.6879	0.0482
Goodness of Fit Measures		
Log Likelihood Ratio (15 df)	Chi-Square = 191.0467	<0.0001
Generalized R-Square = 0.1986	Max-rescaled R-Square = 0.2657	

*** Significant at .01 level
** Significant at .05 level

The goodness of fit for the difference-in-difference model is similar to the previous specialist model, but the Max-rescaled R-Square indicates that the independent variables explain 26.57 percent of the variation in the dependent variable. As shown in Table 20, the classification table results indicate that the difference-in-difference model correctly classifies 65.1 percent of the observations. Further, the model correctly classifies 68.4 percent of the stayers and 61.1 percent of the leavers as indicated by the "sensitivity" and specificity results, respectively. Hence, the model has a good fit and provides a better estimation of the true effect of the increased OPTEMPO.

Table 20 Classification Table for Specialist Difference-in-Difference Model

	Correct		Incorrect			Percentages			
Prob Level	Event	Non-Event	Event	Non-Event	Correct	Sensi-tivity	Speci-ficity	False Pos	False Neg
0.56	325	237	151	150	65.1	68.4	61.1	31.7	38.8

b. Interpretation and Evaluation of Coefficients

The years of service variables (YOS and YOSSQ) were found to be individually and jointly significant in the specialist model. The positive sign of the YOS variable indicates that the number of years of service has a positive influence on the continuation behavior of specialists, as anticipated. The negative sign for the YOSSQ variable is a sign that the positive effect diminishes. To evaluate the total impact of years of service, the following equation for the turning point of the quadratic function was employed: $\beta_1 \div 2(\beta_2) = 0.7717 \div 0.0456 = 16.92$. Therefore, the effect of years of service is positive but diminishing until an individual accumulates 16.92 years of service then the effect becomes negative. The significance of this switch from positive effect to negative effect is diminished since more than 96 percent of the individuals have less than 16.92 years of service. Furthermore, 75 percent of those exceeding the 16.92 years of service turn-around point chose to stay in the military. Thus, years of service has an overall positive effect on the continuation behavior of specialists. As specialists accumulate more years of service creditable towards military retirement, they are more inclined to continue on active duty.

Similar to the GMO model, the FEMALE variable was insignificant in the specialist model. Gender does not appear to influence the continuation behavior of specialists in the current sample. Given the profession and typical working environment, it is possible that males and females view their military obligations similarly without the obstacles that generally create gender-specific behavioral differences.

The race/ethnicity variables were found to be jointly insignificant in the model and subsequent linear hypothesis tests failed to distinguish any significant differences between the BLACK, HISPANIC, and OTHERRACE variables. As such, the variables were combined to create a new variable (MINORITY) because membership in a

minority group is generally believed to influence behavior, either positively or negatively. The MINORITY variable also proved to be insignificant in the model. Since the sample has a relatively small percentage of minority members with various race/ethnic backgrounds, these results are not surprising.

A test for joint significance of the marital/dependency status variables indicated that marital/dependency status does significantly influence the continuation behavior of specialists. Specifically, the SNC variable was significant at the .05 level and positively influenced continuation behavior compared to MWC. In contrast, married specialists without dependents (MNC) had no significant impact on continuation. The difference in continuation behavior for specialists without dependents (MNC and SNC) might be explained by the discomfort associated with being separated from a spouse. In addition, those who are single probably have greater mobility since they are not constrained by coordinating spousal employment and other challenges linked to family responsibilities. Surprisingly, the SWC variable was insignificant in the model. The expected negative impact did not materialize, but this may result from the selection of occupational specialties that minimize the negative impacts of military service (i.e. choosing a specialty with limited deployment possibility or choosing a specialty that restricts the likelihood of relocation). Alternatively, dedicated specialists may have adjusted to the rigors of military service and made the appropriate accommodations for their dependents; thereby, facilitating their continued military service.

The occupational specialty variables (SURG and OSPEC) were individually and jointly significant in the model at the .01 level. As predicted, the negative signs indicate that being either a surgical specialist or any other specialist (not primary care or surgical) significantly decreases the likelihood of continuation when compared to Primary Care specialists. Since these specialties typically receive more specialized training and face a larger civilian-military pay disparity, they are more prone to pursue a lucrative civilian career than primary care specialists, all else being equal.

The duty type/location variables (NNMC, NMCP, NMCSD) were jointly insignificant in the model; however, they were retained to determine if any were individually significant and if the effect was as anticipated. Only NMCSD was

significant in the model, at the .05 level; but the effect was opposite of the expected negative effect. Both NNMC and NMCP had negative signs, as anticipated, but neither was significant. The unexpected positive impact of the NMCSD variable may reflect organizational-specific or geographic-specific attributes that affect the continuation decision. Possibly, the political pressures and bureaucratic aspects of normal operations creates a less stressful working environment at NMCSD. Conversely, physicians assigned to NMCSD may face factors outside the military environment that prompt continued military service (i.e. community support, cost of living, employment opportunities, etc). Regardless of the specific cause, specialists stationed at NMCSD when making their first continuation decision tend to stay in the military at significantly higher rates than those assigned elsewhere.

The DEPLOYED variable, which captured the effect of deployment before the increased OPTEMPO, was significant in the model at the .01 level leading to the tentative conclusion that deployments positively affect the continuation behavior of specialists. These findings match the positive effect found in many previous studies (Hosek & Totten, 1998, Hosek & Totten, 2002, Fricker, 2002, Pierre, 2005). Unfortunately, these results do not directly address the primary concern of this thesis – determining the effect of increased OPTEMPO on continuation behavior. Since the OPTEMPO has significantly increased from 1999 to 2002 and the continuation rates of those who actually deployed decreased, the difference-in-difference estimator (FY02_DEPLOYED) is used to determine the real impact of deployments in the 2002 sample relative to the 1999 sample.

As with the GMO model, the FY02 variable was insignificant in the model. In contrast, the difference-in-difference estimator (FY02_DEPLOYED) was significant in the model at the .05 level and negatively influenced the continuation behavior of specialists, as hypothesized. Therefore, the results indicate that the increased OPTEMPO experienced in the latter period has produced a significant negative influence on the continuation of specialists. To determine the degree of the negative influence of increased OPTEMPO and influence of other significant variables, the partial effects are calculated.

c. Significant Variables and Partial Effects

(1) Notional Person. The results of the specialist model indicate that the notional person has a 75.21 percent chance of continuing on active duty. The notional person is a white male who is married with dependents. He is a primary care specialist with approximately 8.79 years of service and was not assigned to National Naval Medical Center, Bethesda, Naval Medical Center, Portsmouth, or Naval Medical Center, San Diego when making his retention decision. Furthermore, he has not deployed (as a specialist) prior to making his retention decision.

(2) Partial Effects. Table 21 shows the partial effect of significant variables in the specialist difference-in-difference model. The notional person has a 75.21 percent probability of continuing his military service. For a person similar to the notional person except that he has an additional year of service, the probability of continuation increases by 5.55 percentage points. If an individual is comparable to the notional person with the exception of being single with no dependents, the likelihood of continuation increases by 7.10 percentage points.

The chance of continuation increases by 12.55 percentage points for an individual sharing the same characteristics as the notional person except that he deployed before the operational tempo increased. Conversely, the probability of continuation decreases by 40.33 percentage points for a person similar to the notional person except that he is a surgical specialist. Likewise, the chance of continuation decreases by 28.69 percentage points if the individual is exactly like the notional person with the exception of not being a primary care or surgical specialist. If the notional person were assigned to Naval Medical Center, San Diego when making the retention decision, the likelihood of continuation increases by 7.60 percentage points compared to being assigned to anywhere else other than Naval Medical Center, Portsmouth or National Naval Medical Center, Bethesda. For a person similar to the notional person except that he deployed after the operational tempo increased, the probability of continuation decreases by 14.81 percentage points.

Table 21 Partial Effects of Specialist Difference-in-Difference Model

Variable	Partial Effect
YOS***	0.0555
SNC**	0.0710
DEPLOYED**	0.1255
SURG***	-0.4033
OSPEC***	-0.2869
NMCSD**	0.0760
FY02_DEPLOYED**	-0.1481

*** Significant at .01 level
** Significant at .05 level

d. Restricted Model Tests

The years of service, marital/dependency status, race/ethnicity status, occupational specialty, and duty type/location variables were tested to determine if they were jointly significant in the model. Additionally, linear hypothesis tests for combinations of the race/ethnicity variables were conducted to evaluate the possibility of combining categories due to small sample sizes and previous research indicating different effects of race/ethnicity in determining the continuation behavior of specialists (Christensen et al., McMahon et al.). Table 22 summarizes the restricted model tests for the specialist model.

A test for joint significance indicated that the years of service variables were jointly significant at the .01 level. Hence, the variables together are jointly significant in predicting the continuation behavior of specialists. Likewise, the marital/dependency variables were shown to be jointly significant at the .10 level. As such, the SWC, MNC, and SNC variables are useful in predicting the behavior of specialists facing the continuation decision. A test of joint significance for the race/ethnicity variables indicates that race/ethnicity is not important is predicting the continuation behavior of specialists. Given that nearly 90 percent of the sample is white,

these results are not surprising. However, as the racial composition of physician specialists becomes more diverse, the impact of race/ethnicity may become more pronounced as indicated in other research with more racially diverse samples (Fricker, Hosek & Totten). Therefore, some indication of minority membership is deemed important in the analysis. The linear hypothesis tests failed to identify any significant differences between the behavior of blacks and Hispanics, blacks and members of other racial groups, and Hispanics and members of other racial groups. In fact, no significant differences could be found between any of the race/ethnicity variables. Consequently, all race/ethnicity variables were combined into a new variable (MINORITY) that encompasses all non-white members of the specialist sample.

The occupational specialty variables were found to be jointly significant in the model at the .01 level. These results indicate that the variables together are significant in the model and that occupational specialty is important in predicting continuation behavior. In contrast, the joint significance test for duty type/location indicates that duty type/location is insignificant in predicting continuation behavior. Since one of the research questions of this thesis pertains to duty type/location, the choice was made to leave them in the model to determine if any of the three variables, individually, had a significant effect and if the effect was as anticipated.

Table 22 Specialist Difference-in-Difference Model Joint Significance Tests

Test	Wald Chi-Square	DF	Pr > ChiSq
Years of Service	93.8738	2	<0.0001
Marital/Dependency Status	5.6024	3	0.1326
Race/Ethnicity*	3.0905	3	0.3779
Occupational Specialty	69.1104	2	<0.0001
Duty Type/Location	4.8774	3	0.1810

* Test conducted prior to combining variables into a single variable (MINORITY)

e. Potential Problems with Model

In the specialist difference-in-difference model, a squared term for years of service (YOSSQ) was previously added to address functional form misspecification. As a result of its significance in the model, it was retained. Similar to the GMO model, multicollinearity exists between some of the variables in the current model. The VIF test showed that multicollinearity existed between the YOS, YOSSQ, SURG, OSPEC, DEPLOYED, FY02, and FY02_DEPLOYED variables. Much of the collinearity is expected due to the nature of the variables involved; however, the collinearity connected with the SURG and OSPEC variables is primarily caused by the training obligation associated with certain occupational specialties resulting in more years of service before reaching the retention decision point.

Another potential problem for the specialist difference-in-difference model is omitted variable bias. The moderate Max-rescaled R-square (0.2657) indicates that useful variables were likely omitted from the model. Variables such as civilian-military pay differential, unemployment rate, and satisfaction with military life, among others, are often useful in explaining the retention behavior of military members. The incorporation of these variables would likely improve the model's predictive value and reduce bias in the coefficients.

3. Comparison of Models

The initial logistic regression model of the combined specialist sample indicates that deployments have a significant positive effect on the continuation decision similar to the majority of previous research. However, the difference-in-difference model clearly demonstrates that the increased OPTEMPO is producing a significantly different effect on the continuation behavior of specialists. The extremely significant positive effect of deployments prior to the increased OPTEMPO appears to mask the detrimental effects of deployments after the increase in OPTEMPO. The difference-in-difference model identifies a clear demarcation of specialist continuation behavior. Given the intent of this thesis, the difference-in-difference model is the best empirical model to answer the question. Previously, deployments produced a significant positive effect on the continuation behavior of specialists, but current operations appear to yield a substantially different effect. The initial logistic regression model does not capture the differing

effects. Even more troubling, the initial logistic regression results could lead to conclusions that the increased OPTEMPO has not impacted the positive effect of deployments on continuation. Therefore, the difference-in-difference model is preferred to answer the posited question and to demonstrate the impact of increased OPTEMPO on the continuation behavior of specialists.

D. SUMMARY

The factors affecting the continuation behavior of generalists and specialists are substantially different; thereby, requiring the estimation of different models. For both generalists and specialists, the pooled sample did not reveal substantial differences across the two time periods. Thus, separate models were not required for each time period to evaluate the continuation behavior of specialists and generalists. Although the initial logistic regression model for generalists failed to demonstrate that deployments exerted a significant effect on continuation behavior, the thesis sought to determine the effect (if any) that the increased OPTEMPO had on continuation. Therefore, a difference-in-difference estimator was utilized to isolate the effect. As a result, the effect of increased OPTEMPO was determined to have significantly reduced the continuation behavior of generalists by 9.59 percentage points.

With regards to specialists, the initial logistic regression model indicated that deployments produced a significant positive effect on the continuation behavior. Unfortunately, the results do not distinguish the effect of increased OPTEMPO experienced in the latter time period. Again, a difference-in-difference estimator was employed to determine if the effect was significantly different due to increased OPTEMPO. The revised model illustrated that deployments generally have a significant positive effect on continuation; however, the effect due to the increased OPTEMPO was significantly negative. In the end, the effect of increased OPTEMPO was associated with a 14.81 percentage point decrease in the continuation behavior of specialists.

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VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

Retention studies are conducted to identify factors that significantly impact an individual's retention decision, either positively or negatively, so that policies can be developed and implemented to achieve the desired retention behavior needed to meet manpower requirements. Although limited, this study identifies some potential factors affecting the retention behavior of Navy physicians. Further, the study explores the impact of increased OPTEMPO, subsequent to September 11th, on the retention behavior of physicians.

While this thesis focused on the effect of increased OPTEMPO on Medical Corps officer retention, the current difficulties in attracting and retaining physicians presents a multi-faceted problem. The effects of increased tempo may inadvertently capture some of these additional problems: civilian-military pay gap, increased pressure for productivity, administrative burden, and other pecuniary and non-pecuniary issues not incorporated in the analysis. Regardless, the preliminary analysis indicated that the retention of General Medical Officers (GMOs) and specialists declined from 2002 to 2005. The decline in GMO retention was not significantly different; however, the 8 percentage point decrease for specialists was significant.

1. General Medical Officers

The demographic characteristics of the GMO samples varied little across time. The only significant differences were the increase of physicians who were single with dependents and a decrease in physicians who were single without dependents. The military experiences of GMOs were also similar; however, physicians in the latter sample experienced significantly more deployments, as anticipated. The continuation rates for GMOs only varied appreciably for those who deployed or those who were Undersea Medicine physicians, both of which experienced notably lower continuation rates in the 2002 sample when compared to the 1999 sample.

Regression analysis of the combined GMO model illustrated that years of service, race, being single with dependents, and occupational specialty significantly affected

retention behavior. An additional year of service, being a member of another racial group (not white, black, or Hispanic), being a Flight Surgeon, and being an Undersea Medicine physician positively affected retention. The negative influences included being black, Hispanic, or being single with dependents. The analysis of the combined GMO model failed to demonstrate that deployments drastically affected the retention decision. To evaluate if the increased OPTEMPO significantly altered the retention behavior of GMOs, a difference-in-difference estimator was employed. The subsequent results of the difference-in-difference model showed that GMOs who deployed after the increase in OPTEMPO were considerably less likely to continue military service.

2. Specialists

The demographic attributes of specialists were similar across the two samples with only two significant exceptions: an increased percentage of black specialists in 2002 and an increased percentage of single specialists with dependents. The military experiences of specialists were also comparable; however, specialists in the 2002 sample experienced significantly more deployments, as expected. The continuation rates for specialists deviated considerably for the following subgroups: white specialists, males, those married with dependents, those single with dependents, those assigned to any duty station other than the "Big 3", those assigned to Naval Medical Center, San Diego, those who deployed, primary care specialists, and other specialists (not primary care or surgical).

Regression analysis of the combined specialist model illustrated that years of service, being single without dependents, being deployed, being assigned to Naval Medical Center, San Diego and occupational specialty significantly affected continuation behavior. An additional year of service, being single without dependents, being deployed, and being assigned to Naval Medical Center, San Diego positively affected retention. Being a surgical specialist or other specialist (not primary or surgical) significantly lowers the probability of continuation. In addition, the difference-in-difference estimator indicated that the increased OPTEMPO has produced a significant negative effect on specialist continuation despite the overall positive impact of deployments for specialists over the 1999-2005 timeframe.

B. RECOMMENDATIONS

The inherent nature of the military requires military physicians to deploy, when directed, to support military operations. Thus, no viable solution can minimize the deployment of physicians without endangering Force Health Protection; however, the Navy should attempt to minimize deployments that are not mission-essential. In addition, an indirect solution could focus on the removal of fundamental factors creating physician dissatisfaction. The 2005 Quick Poll indicated that physicians are most inclined to leave the military due to administrative barriers while increased pressures for productivity also prompt physicians to leave. Regardless, the following recommendations are proposed to counter the Navy's current and future retention and recruitment difficulties created by increased OPTEMPO:

Short Term

- Increase amounts of special pays for critical specialties most negatively impacted by the current operational environment. The added pays may motivate more physicians to continue their military service. In addition, special pays can be adjusted annually, as needed, to attain the desired retention behavior.
- Pursue accession bonuses to augment the current force structure by obtaining specialty-trained physicians. The accession bonuses would alleviate some short term challenges by providing access to trained specialists.
- Increase utilization of reserve physicians to fill requests for support, where authorized. Reserve physicians augment the active force during periods of conflict and can ease some of the hardships created by the increased OPTEMPO.

Long Term

- Explore opportunities for performance-based incentives with concessions for those who endure the rigors of operational medicine. The implementation of managed care has created increased pressure for

productivity without the same financial incentives available in civilian healthcare organizations. Performance-based incentives may assist in retaining high-quality, productive physicians; but some consideration must be given to physicians working in arduous environments without high patient volume.

The above recommendations may not fully solve Navy Medicine's physician retention problem; however, they are proposed as alternative mechanisms to explore in addressing the myriad of issues creating the retention challenge. Although monetary incentives are frequently pursued, the civilian opportunities available to physicians, coupled with a relatively safer working environment, may limit the ability to achieve the desired levels of retention given the current OPTEMPO. Another potential remedy is to increase the active duty obligation for AFHPSP and USUHS accessions. However, it will likely exacerbate the current recruiting problem. As such, more emphasis may be needed on eliminating other dissatisfiers that contribute to the physicians' propensity to leave military service.

C. FURTHER RESEARCH

The opportunities for further research regarding physician retention are numerous and varied. Most previous research focused on the civilian military pay gap which remains an item of interest; especially given the changes in OPTEMPO and integration of managed care. As the military embraces managed care, the perception and behavior of military physicians are expected to change. The enhanced emphasis on productivity, coupled with the rigors of military service, may lead to more retention difficulties. Thus, this research can be extended by encompassing some qualitative information regarding physicians' perceptions of Navy Medicine in the current environment. The 2005 Quick Poll provides some insight; however, a more focused survey of physicians would be useful.

Regarding the effect of increased OPTEMPO, additional research could look at other health care professionals in Navy Medicine (nurses, administrators, and dentists) to determine if the effect is similar. In addition, a cross-service comparison of physician continuation behavior may provide additional insight regarding the severity of the overall physician retention problem in the military. Furthermore, the current analysis focused on

increased OPTEMPO, but was unable to distinguish between different deployment environments (shipboard, Marine Corps units) or geographical regions (Afghanistan, Iraq, OCONUS support, etc). This additional information would have been useful in analyzing behavior, but the data sources utilized for this analysis did not have that level of granularity.

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LIST OF REFERENCES

1. American Medical Association Web Page, http://www.ama-assn.org/ama/pub/, last accessed 10/05.

2. Arthur, D. C., (2005, May 10). Testimony before the Senate Appropriations Committee, Defense Subcommittee on Medical Programs.

3. Ashbaugh, J. L. (2003). The Hard Case for Soft Skills and Retention, Healthcare Executive, 18, 59-60.

4. Brannman, S., Rattelman, C., & Schutte, S., Provider Satisfaction Study, Center for Naval Analyses, Report No. CAB D0002045.A2, Alexandria, VA, 2000.

5. Bureau of Naval Personnel (1969), Medical Department Orientation. NAVPERS 10816-C.

6. Christensen, E., Brannman, S., Almendarez, M., Sanders, J., & Kimble, T., Navy Specialty Physician Study: Historical Overview, Retention Analysis, and Synopsis of Current Civilian-Sector Practices, Center for Naval Analyses, Report No. CRM D0004916.A2, Alexandria, VA, 2002.

7. Cooke, T. W., Marcus, A., & Quester, A. O., Personnel Tempo of Operations and Navy Enlisted Retention, Center for Naval Analyses, Report No. CRM 91-150, Alexandria, VA, 1992.

8. Cotton, J. G., (2004, March 31). Testimony before the Senate Armed Services Committee, Personnel Subcommittee on Guard and Reserve Issues.

9. Cowan, M. L., (2002, April 10). Testimony before the House Armed Services Committee, Subcommittee on Military Personnel.

10. Cowan, M. L., (2003, April 30). Testimony before the Senate Appropriations Committee, Defense Subcommittee on Defense Health.

11. Cowan, M. L., (2004, April 28). Testimony before the Senate Appropriations Committee, Defense Subcommittee on Defense Health.

12. Franco, R. P., A Multivariate Analysis of Navy Physician Retention, Master's Thesis, Naval Postgraduate School, Monterey, CA, 1989.

13. Fricker, R. D., The Effects of Perstempo on Officer Retention in the U.S.Military, The Rand Corporation, Report No. MR-1556-OSD, 2002.

14. Gaffney, J. K., A Turnover Analysis for Department of Defense Physicians, Master's Thesis, Naval Postgraduate School, Monterey, CA, 1988.

15. Golding, H. L. W., & Griffis, H. S., Increased PERSTEMPO, Retention, and Navy Policy, Center for Naval Analyses, Report No. CAB D0008040.A2, Alexandria, Virginia, 2003.

16. Golding, H. L. W., & Griffis, H. S., How Has PERSTEMPO's Effect on Reenlistments Changed Since the 1986 Navy Policy?, Center for Naval Analyses, Report No. CAB D0008863.A2, Alexandria, VA, 2004.

17. Hoewing, G. L., (2005, March 16). Testimony before the Military Personnel Subcommittee of the House Armed Services Committee on Recruiting and Retention and Military Personnel Policy, Benefits and Compensation.

18. Hosek, J., Deployment, Retention, and Compensation, The Rand Corporation, Testimony CT-222, 2004.

19. Hosek, J. & Totten, M., Does Perstempo Hurt Reenlistment?, The Rand Corporation, Report No. MR-990-OSD, 1998.

20. Hosek, J. & Totten, M., Serving Away from Home: How Deployments Influence Reenlistments, The Rand Corporation, Report No. MR-194-OSD, 2002.

21. Kerr, S. A., Retention of First-term and Second-term Marine Corps Enlisted Personnel, Master's Thesis, Naval Postgraduate School, Monterey, CA, 1997.

22. Kirby, S. N., & Naftel, S., The Effect of Mobilization on Retention of Enlisted Reservists After Operation Desert Shield/Storm, The Rand Corporation, Report No. MR-943-OSD, 1998.

23. Krol, J. J., (2002, March 21). Statement before the Senate Armed Service Committee, Readiness Sub-Committee on Current Operations Impacts on Readiness.

24. Lanser, E. G. (2000), Lessons from the Business Side of Healthcare, Healthcare Executive, 15, 14-19.

25. Lanser, E. G. (2003), Our Aging Population: Implications for Healthcare Organizations, Healthcare Executive, 18, 6-11.

26. McMahon, J. S., A Retention Model for Navy Physicians, Center for Naval Analyses, Report No. CRM-89-62, 1989.

27. Mehay, S. L. & Hogan, P. F. (1998). The Effect of Separation Bonuses on Voluntary Quits: Evidence from the Molitary's Downsizing. Southern Economic Journal, 65, 127-139.

28. Navy Personnel Command Web Page, http://www.npc.navy.mil/CommandSupport/ITEMPO/, last accessed 10/05.

29. Newell, C., Whittam, K., & Uriell, Z. (2005, June 6). CNP Quick Poll, Medical Communities, Navy Personnel, Research, Studies, & Technology (PERS-1).

30. OPNAV Instruction 3000.13B, Personnel Tempo of Operations, 11 February 2000.

31. Pathman, D. E., Konrad, T. R., Williams, E. S., Scheckler, W. E., Linzer, M., & Douglas, J., Physician Job Satisfaction, Job Dissatisfaction, and Physician Turnover. Journal of Family Practice, 51, (7), 2002, http://www.jfponline.com/, last accessed 02/06.

32. Pieper, S. K. (2003), Retaining Staff the Magnet Way: Fostering a Culture of Professional Excellence, Healthcare Executive, 18, 12-17.

33. Pierre, K. O., Effect of Increased Operational Tempo (Post 9/11) on the Retention Rate of Hospital Corpsmen, Master's Thesis, Naval Postgraduate School, Monterey, CA, 2005.

34. Rabkin, N. J. (2000). Military Personnel: Preliminary Results from DoD's 1999 Survey of Active Duty Members, (GAO/T-NSIAD-00-110, March 8, 2000).

35. Report on Salary Surveys (2005, May 1). Surveys reveal turnover rates are on the rise.

36. Rhem, K. T., (2001, October 12). High-Deployment Per Diem Stopped for Enduring Freedom. Armed Forces Information Service.

37. Rittenhouse, D. R., Mertz, E., Keane, D., & Grumbach, K., No exit: An Evaluation of Physician Attrition, Health Services Research, October 2004.

38. Rumsfeld, D. H. (2005, January 18). Department of Defense Annual Report to the President and Congress.

39. Tillson, J. C. F., Reducing the Impact of Tempo, Institute for Defense Analyses, IDA Paper 3508, 1999.

40. Warner, J. T., & Asch, B. J. (2001). The Record and Prospects of the All-Volunteer Military in the United States. Journal of Economic Perspectives, 15, 169-192.

41. Warner, J. T. & Goldberg, M. S. (1984), The Influence of Non-Pecuniary Factors on Labor Supply: The Case of Navy Enlisted Personnel. Review of Economics and Statistics, 66, 26-35.

42. Weiss, H. M., MacDermid, S. M., Strauss, R., Kurek, K. E., Le, B., & Robbins, D. (2003). Retention in the Armed Forces: Past Approaches and New Research Directions, Military Family Research Institute, Purdue University.

43. Wolf, E. J. (2001), Four Strategies for Successful Recruitment and Retention, Healthcare Executive, 16, 14-18.

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